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Volume VIII**December 1938****Number 5**

EDUCATIONAL TESTS AND THEIR USES

Reviews the literature from July 1935 to July 1938

Prepared by the Committee:

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FOREWORD

THIS ISSUE of the *Review of Educational Research* deals with the construction and use of tests which evidence pupil growth in abilities. The issue includes studies of these abilities as measured by tests (Chapter I), and to some extent it touches upon habits of behavior, attitudes, and interests. These are coming to be recognized more and more in the objectives of instruction, and are therefore closely related to the field of educational testing. In the main, however, tests of personality, character, attitudes, and intelligence are left to the *Review* dealing with "Psychological Tests and Their Uses," the last issue of which was in June 1938. That issue, and its bibliography, should be considered as supplementary to the present number.

The treatment in the present issue is concerned with the larger aspects of educational measurement. Testing in individual subject fields is not treated specifically; one should consult the recent numbers on "Special Methods and Psychology of the Elementary-School Subjects" (December 1937), "Psychology and Methods in the High School and College" (February 1938), and "The Curriculum" (April 1937) for measurement as related to subject fields.

One will note that many of the problems in the field of educational testing are problems of judgment. This should not be discouraging to research workers. Factual material must always fit into a matrix of human thought and value if it is to be used advantageously. The thing for research workers to feel legitimate concern about is whether they have sensed the real problems, and whether they are doing all that is within their power to attack these real problems, so that they can turn over to the practical educator facts which are as free as possible from error, and which are germane to the problems that are basic.

DOUGLAS E. SCATES,
Chairman of the Editorial Board.

INTRODUCTION

THIS *Review of Educational Research* attempts a slight change in organization from previous reports on "Educational Tests and Their Uses." This change is due partly to the fact that the contributions of the period stress somewhat different aspects of measurement, and partly to the fact that it appeared to be unnecessary to duplicate certain areas which recently have received entirely adequate treatment.

Several hundred titles representing the test literature of the period from June 1935 to June 1938 were examined, abstracted, and fitted into the tentative outline of the report. Limited research contributions in certain quarters forced modifications of the outline originally planned. Further modification was necessitated by virtue of the very complete and detailed report of "Psychological Tests and Their Uses" in the June 1938 *Review*. The inclusion of material on vocational, aptitude, and personality tests, as well as an unusually critical and complete treatment of statistical methods related to test construction, made it advisable not to duplicate these treatments in this number of the *Review*.

Notwithstanding that this report is basically a review of research it was felt that there are trends in the thinking of those most interested in the improvement of educational measurement which are not fully represented in completed research. Accordingly, and at the risk of some criticism, the Committee includes in this review certain trends and basic issues which have been expressed or observed during the period covered, but which might not be evident in the research itself.

The chairman of the Committee wishes to thank the members and all others interested in this field who by their suggestions and criticisms have aided in the development of the outline and of the report itself.

HARRY A. GREENE, *Chairman,*
Committee on Educational Tests and Their Uses.

CHAPTER I

Studies of Educational Achievement¹

PAUL V. SANGREN

Dependence upon Validity of Measurements

A NUMBER OF WRITERS rightly question the value of experimentation in which wholly or partially inadequate tests are used as measures. Orata (63) pointed out that "we cannot be progressive in our teaching and remain basically traditional in our testing." J. S. Gray (40), in a similar vein, said: "The adequacy of objective tests for evaluating hypotheses in education is obviously much inferior to that in the more basic sciences. It is more difficult to control the variables. However, a part of research training for this step is to learn the better methods of testing and their limitations. Educational research is in dire need of more objective and more adequate methods of testing our great mass of unproven theories." Payne (67) made similar remarks in regard to evaluation in higher education. In an indictment of meaningless and superficial research he said: "I have not made these remarks about experiments just to be critical. . . . I have made them primarily because we have no very accurate ways of measuring the results of the experiments. . . . If, then, we wish to advance education from the point of view of science, the greatest need of research in the field of higher education is in the field of measurement." Newland (61) blamed both college educators and research workers for the dearth of research at the college level. The former, according to Newland, cannot agree as to the function of higher education, and the latter hold too narrow a conception of measurement. Peik (69), although speaking particularly with reference to experimentation in curriculum research, stated an opinion which is also applicable to educational research in general.

The value of innovation in experimental groups was determined by initial and final measurements of status. This method of evaluation through tests depends upon the reliability and validity of the instruments of measurement. Whereas testing is scientific in theory, and experimentation is a basic approach to curricular development, this type of research is still limited in value through a lack of instruments that are wholly valid and sufficiently refined. In some important sectors tests of outcomes are yet either lacking or in a very crude state of development. Suitable tests are essential to the progress of research through measurement. . . .

Evaluation of Achievement Tests

A comparison of the New Stanford Achievement Test and the Modern School Achievement Tests was made by Woolf and Lind (97). Results showed that the Stanford Achievement Test indicated a slight superiority

¹ Bibliographv for this chapter begins on page 554.

in statistical evaluation and tended to give slightly higher age and grade levels according to means obtained in a comparison of individual tests. The writers concluded with the statement that the two tests are so similar in content and in their correlation with other tests that the use of either is justified. A study by Pullias (72) reported variability in results from objective achievement tests. Thirty-five teachers constructed 63 examinations in geography, history, and health. These were paired and administered to 68 groups. Three standardized objective tests in each of seven subjects and two in each of three subjects were also administered to 460 sixth-graders. Conclusions to be drawn from this study are, according to the author, that (a) a test may be objective in the sense that personal opinion is eliminated in scoring and still fail to remove important personal elements from the evaluation of pupils' achievement; (b) measures of pupil achievement obtained from different informal objective tests may be expected to vary to a considerable extent; and (c) pupil ratings based upon standardized tests show marked disparity.

H. A. Gray (39) studied tests recorded and reproduced by sound. Three hundred and seventy pupils in Grades II through VIII were subjects. Tests were adapted from the arithmetic reasoning, language usage, and spelling sections of the Modern School Achievement Tests, and arranged in both sound record and mimeographed form. After analyzing the scores made on the two types of test, Gray concluded that "the pupils in question were able to detect errors in spoken language more readily than they could in the printed form." The results were not conclusive, however, and more experimentation in this field is needed.

Studies of General Achievement

In a study of variations in educational accomplishment in a number of school subjects among children of normal intelligence, Stout (81) reported that although the intelligence quotients of children may be normal it is clear that they are not as a rule homogeneous in other traits. For this study a wide range of rating scales and aptitude, achievement, and mental tests of both the individual and the group types were used.

Schrepel and Laslett (78) tested 121 junior high-school pupils in Grades VIII and IX with the New Stanford Tests in the spring and again in the fall to check the loss of knowledge during the summer vacation. The results showed no serious losses with the possible exception of arithmetic computation. The authors concluded with the suggestion that strenuous reviews in the autumn are psychologically and pedagogically questionable.

Experiments comparing the educational achievement of various groups are reported by several authors. For example, Breidenstine (6) reported a study concerning the educational achievement of pupils in differentiated and undifferentiated groups. The New Stanford Achievement Tests were used to measure educational achievement. A summary indicated that both

groups were about equal in mean composite score, and that both were almost equal in E.Q. The undifferentiated group was slightly superior at every level, however. Moore (57) reported a study of the educational achievement of delinquent and dependent boys. The Otis Self-Administering Test, Intermediate and Higher Examinations, and the Modern School Achievement, Short Form (spelling omitted), were administered. The author stated, "When the subjects in this study are compared with local norms of retardation, normalcy, and acceleration for chronological age, both groups are considerably below the Tennessee school children." In fact, the dependents showed twice as high a retardation, and the delinquents three times as high. Scholastic difficulties of the children of immigrants have been studied by Overn and Stubbins (64). Native American children made up the control group and children from foreign language speaking homes made up the experimental group. The Pintner Cunningham Primary Mental Test and the Metropolitan Achievement Tests were used. The authors concluded that "special procedures should be found to aid the entrants to the first grade from foreign language speaking homes to overcome language handicaps as rapidly as possible."

Smeltzer and Adams (79) reported a study of the educability of transients. Forty-three transient boys, who were admitted to the Industrial School at Lancaster, Pennsylvania, to receive an extensive six months' course in vocational education, were administered the Terman Group Test of Mental Ability, Form A, the New Stanford Achievement Examination, Advanced, Form V, the Stenquist Mechanical Aptitude Tests I and II, and the Thurstone Personality Schedule. Final tests, administered to the twenty-five remaining subjects, consisted of other forms or repetitions of the same form when only one was available. Results showed that "contrary to many subjective statements regarding the characteristics of transient adolescents who have taken to the 'road' during the past few years, many of these boys appear to be typical members of a population with unfortunate situations in home environment. . . . These transient boys represent a group of late adolescents who are definitely educable."

Traxler (87) and Ross (77) reported experiments involving the relationship of achievement to various other factors. The former was concerned with the correlation of achievement scores and school marks. The Cooperative Test Service Examinations were used for 20 school subjects and reading was measured by the Nelson-Denny Test. Marks assigned on a percent basis during the year 1934-35 in eight independent secondary schools for boys were also used. Traxler stated, "The general conclusion to be drawn from this article is that, although intelligence and reading skill, as measured by the American Council Psychological and the Nelson-Denny tests, operate to raise the correlation between scores on achievement tests and school marks, a positive and significant degree of relation usually exists aside from the influence of either of these facts." Ross (77) attempted to determine the relationship between intelligence, scholastic

achievement, and musical talent. Subjects were 1,541 pupils in Grades V through XII in the California public schools. Intelligence was measured by the Terman Group Test of Mental Ability, achievement by the Stanford Achievement Test, Form V, and musical talent by the Seashore Tests of Musical Talent. Results showed a low degree of relationship between intelligence and musical talent. Relationship between scholastic achievement and musical talent is so low that a measure in one cannot be used to predict a score in another.

Prediction of School Success

Factors useful in predicting educational success have been the subject of various studies. Dunlap (24) reported a study of preferences as indicators of specific academic achievement. He concluded, "It would seem that if the preliminary form of the preference blank described were refined and extended, the expressed preferences of an individual could be used to increase materially the accuracy of the prediction of future academic success at the junior high-school level." Ficken (30) studied the subject of predicting achievement in the liberal arts college. He found that the Minnesota College Aptitude Test correlates higher with grade point averages at the end of one semester and at the end of one year in the case of women than in that of men. Unsegregated College Aptitude Test scores and grade point averages show low correlations. However, high-school rank and grade point averages gave a correlation of .67. Ficken stated, "One cannot avoid the conclusion that the College Aptitude Test is of doubtful value for general prediction purposes at this institution. . . . It does not follow that the test is not a good one for other purposes, such as, for example, the motivation and guidance after matriculation of those students who are not working up to capacity."

Variations among high-school seniors in promise and performance measures were studied by Eckert and Mills (27). Four hundred and forty-two high-school seniors in the college entrance curriculum in the Buffalo high schools were the subjects. Achievement was measured by the average on the Regents' examinations; promise was measured by a lengthened form of the American Council Psychological Examination. Other tests were administered as follows: the history and English parts of the Iowa High-School Content, the Strong's Vocational Interest Blank for boys, the Manson Occupational Interest Blank for Women, the Neumann Test of International Attitudes, Zyve's Stanford Scientific Aptitude Test (modified), and Willoughby's Revision of the Thurstone Personality Schedule. Results led to the following conclusions: (a) Teachers' marks are as good a criterion for differentiation as the Regents' examination. (b) Performance in mathematics and science is more indicative of scholastic application than marks in other fields. (c) Measures of studiousness show some of the clearest differences.

Peck (68) was concerned with the relationship of drawing performance

and school achievement of young children, and with special factors influencing that relationship. A non-verbal group test (Prediction Test) based solely on drawings of beginning children was administered to 1,000 children. Correlations with Gates Reading Tests, a flash-card word test, and teachers' estimates of school achievement led to the conclusion that "children's drawings, obtained in the manner chosen for the study, probably furnish as accurate prediction of school success as do other predictive measures in common use."

Achievement in Reading

Reading readiness—Hilliard and Troxell (48) reported a study of informational background as a factor in reading readiness. Tests used were the Sangren Information Tests, Smith Vocabulary Test, and the Healy Picture Completion Test. Reading readiness was measured by the Lee-Clark Reading Readiness Test and the Stone-Grover Classification Test. The Gates Primary Tests were used to measure reading status at intervals. The rich background group was decidedly ahead of the meager background group in sentence and paragraph reading, and only slightly superior in word recognition. Wilson and Burke (95) studied reading readiness and later achievement. The Van Wagenan, Metropolitan, and Stone-Grover Tests were administered to first-grade pupils. These scores were correlated with fourteen reading tests, teachers' November ranking of predicted achievement, and teachers' May ranking of actual achievement. Teachers' November prediction gave the highest correlation with reading ability as later measured by tests. A continuation of this study is also reported, with similar conclusions (94).

Grant (38) compared the predictive value of the Metropolitan Readiness Tests with the Pintner-Cunningham Primary Mental Test. Two hundred and sixty first-graders were subjects. Two years after the administration of these two measures, the Gates Primary Reading Test was administered. To those making perfect scores on this measure, the Metropolitan Achievement Test in Reading was administered and in some cases the DeVault Primary Reading Test. Results indicate that the Metropolitan Readiness Test measures factors significantly related to later success in reading skills and that it is on a par with the Pintner-Cunningham in providing a basis for prediction.

Dolch and Bloomster (18) reported an experiment involving phonic readiness. General maturity was measured by the Pintner-Cunningham Primary Mental Test and the Detroit First-Grade Intelligence Test. Tests 1 and 2 of the Basic Reading Tests, Word Attack Series, were used to measure the use of phonics. Results showed that children below seven years of age made only chance scores in phonics. These results, according to the authors, may indicate a minimum age for teaching phonics.

Studies of primary grade reading—Hill (47) studied the process of word discrimination in individuals beginning to read. Pupils were re-examined

after twelve or fourteen weeks of training, with achievement tests which consisted of the actual reading material presented to the subjects during the training period. Training tended to direct attention to the beginning of words, and even though individual patterns were somewhat affected, the group pattern of difficulties showed little change over the training period and under the teaching methods employed. Donnelly (20) studied the growth of word recognition in Grade I. Three hundred and eighty-nine first-graders were given a test of 150 words chosen at random from the first two levels of the Gates Vocabulary List. Of thirty pupils in the bottom tenth at the end of the third month, twenty were in the same position at the end of the year. Girls were superior to boys. The author concluded that there is need for more inventory testing to determine mastery of basic vocabulary.

McDade (53), in an experiment with first-graders, eliminated oral reading entirely. Results from the Gates and Metropolitan Primary Reading Tests at the end of the year showed gratifying results. Comparisons with classes taught by other methods were favorable to the non-oral reading group. Individualizing instruction in reading as tried by Worlton (98) in the Salt Lake City schools showed significant gains as measured by the Gates Reading Tests, Types A and C. Games as a means of teaching arithmetic and reading were considered by Goforth (36). Read-O and Add-O were the games employed with second-grade pupils. Marked gains were reported together with increased interest. Wheeler (93) also reported a study involving the Read-O games. Experimental and control groups were set up in the first grade on the basis of the Dearborn Intelligence Tests. A final measure of reading was obtained through the use of the DeVault Standardized Reading Tests. Results showed a high correlation between the word recognition of Read-O and general achievement. The relationship of pictures to reading was studied by Miller (55). Initial and final tests on three stories were constructed; no significant differences for the use of pictures were found.

Reading in the higher grades—Traxler (88) reported the results of an experiment in teaching corrective reading to eight seventh-grade pupils for nine weeks. According to results of tests, seven "derived considerable lasting benefit from the instruction." Garrison (33) was also interested in a remedial reading program with pupils in the ninth grade. Sangren-Woody Tests were used as initial and final measures. Out of 33 pupils, of whom all but two were reading at the sixth-grade level, all but four showed improvement.

Seeking new methods and objectives in teaching dull-normal pupils of the upper grades to read, Walcott (92) employed the work-sheet method to facilitate the study of subjectmatter and to cultivate skills constituting reading ability. A retest with the Iowa Silent Reading Test seemed to substantiate the use of this method. Another experiment employing three instructional units yielded encouraging gains for low average pupils.

Gates and Bond (34) studied five "dull-normal" and one remedial reading group in the Speyer Experimental School. The Modern School Achievement Test was initially administered in February and finally in June. No formal classes were held in subjectmatter areas, but special attention was given to the developing of competence in reading. Reading gains in all classes were large, ranging from six to thirteen months. Additional measures were applied in the form of the Gates Primary and Advanced Reading Tests. The average I.Q. represented by the classes was 82.

Cramer (13) reported a study involving the administration of reading and arithmetic tests, constructed and administered in Australia, to 1,000 California and Washington pupils. Results indicated a tendency for Australian children to score better in arithmetic and for American children to score better in reading except in Grades VII and above.

Vocabulary studies were reported by Anderson and Fairbanks (1) and Tilley (84). The former were concerned with differential factors in reading and hearing vocabularies of university freshmen. The Inglis Tests of English Vocabulary were used. Conclusions are that "vocabulary ability is a centrally determined function, operating, on the average, independent of the mode of presentation of material." The study by Tilley reported a technic for determining the relative difficulty of word meanings among elementary-school children. A multiple-response test was constructed from the Survey Tests of Vocabulary, the Lower Extension of the Inglis Vocabulary, and eighty words of the vocabulary section of the Stanford Achievement Examination. A self-appraisal technic was also employed. This technic apparently had a rather high validity which varied as did the intelligence of the children.

Bilingual children—Reading and arithmetic abilities of Spanish and English speaking children have been studied by both Manuel (54) and Kelley (49). The former is concerned with both tool subjects. The average Spanish speaking child suffers a serious and persistent language handicap at least as high as the eighth grade. Kelley found results similar to those of Manuel; the Spanish speaking children were below the norm in all grades, with deficiencies unconfined to any particular phase of reading ability.

Reading and various factors—Tinker (85) studied the reliability and validity of eye movement measures of reading. Seventy-seven university sophomores and fifty-seven freshmen were subjects. Where group comparisons are concerned, eye movement measures for as few as five or six lines have adequate reliability; in individual diagnosis, however, twenty or more lines are necessary for adequate reliability. Tinker and Paterson (86) studied typographical factors influencing speed of reading on the Chapman-Cook Speed of Reading Test. Cloister black retarded reading about 16 percent. Traxler (90) found no significant differences between the sexes in rate of reading in high school. Anderson and Tinker (2) studied speed in reading performance of 110 college sophomores tested

individually on the first five parts of the Iowa Silent Reading Test. They found that "the data justify the conclusion that when an adequate method of measurement is employed, there is an intimate relation between rate of reading and comprehension scores for the type of material here considered."

Pace (65) studied laterality and reading ability in high school and college. Laterality was determined by means of a questionnaire. The Minnesota Reading Examination, Form A, and the Minnesota Speed of Reading Test, Form A, were administered. Students who were shifted, ambidextrous, or left-handed showed no significant inferiority on the Minnesota Reading Examination, but some inferiority was apparent for this group on the Minnesota Speed of Reading Test.

The relation of ability in reading to success in other subjects was investigated by Finck (31) by means of the controlled group technic. For twenty-two pairs from Grades IV through VIII it was found "that improvement in ability to read is accompanied by improved achievement in those subjects which involve a great deal of reading." McCullough (52) conducted a similar study with ninth-graders.

Swanson and Tiffin (83) were interested in the relationship of performance on the Betts Telebinocular and the Iowa Silent Reading Test of 267 freshman men. Conclusions reached seem to indicate that it is "improbable that differences in visual efficiency are causally related to differences in reading ability among college students. . . . This statement is equally true whether intelligence is left uncontrolled or whether it is held constant by means of partial correlation." Witty and Kopel (96) have used the Betts tests of visual sensation and perception and of oculomotor and perceptual habits in an effort to determine the relationship of poor reading to reversals, fusion difficulties, muscle imbalances, and mixed eye-hand dominance. This latter factor was measured by a modification of the Koch handedness questionnaire, the manoptoscope, dynamometer, and other devices. Subjects were 100 public school children, with I.Q.'s of 80 or above, whose reading scores were lowest among 2,000 pupils in Grades III to VI, inclusive, on several standardized tests. The Metropolitan and Gates Tests indicated that the control group was one and one-half grades better in reading. Conclusions reached were that "the etiology of reading disability (as an entity) lies in no single visual (or other noumenal) factor."

Achievement in Arithmetic, Algebra, and Geometry

Porter (71) reported a three-part experiment to determine the effect on achievement in geometry and algebra of spending one class period a week on mathematical recreation. The Otis Self-Administering Test, the Lane-Greene Unit Achievement Tests in Plane Geometry, the Hotz First Year Algebra Scales, Hart's Geometry Tests, the Columbia Research Bureau Plane Geometry Tests, a county eighth-grade examination, and the

Silance-Remmers Scale for Measuring Attitude toward Any School Subject were administered. Results showed that the experimental groups were most interested, and the conclusion reached by the author was that the use of mathematical recreation in class work is advantageous for achievement.

Morrison (59) conducted an experiment to evaluate the mass method versus the individual method in teaching multiplication to fourth-grade pupils. Sixty-two pupils were taught according to the mass method and 75 pupils were taught according to the individual method. In October the Wilson Process Test in Multiplication, 5P, was used as an initial test. It was repeated as a final measure in March and as a retest in the following September. Forty-seven periods of 45 minutes each were used. The individual group used the Wilson Drill Book in Multiplication. Results showed that the individual method group experienced a slightly greater gain and also made a greater permanent gain. Betts (3) reported the results of a study involving the use of a calculating machine for arithmetic instruction. Thirteen pupils in Grade VIA were subjects. Tests used were the Compass Survey Test and the Compass Diagnostic Test (XVIII, Problem Analysis). The author reported: "Limited test data secured so far probably are of value only to the degree that they permit a forecast of factors to be controlled in a more extensive investigation. . . . The typical instructional material for the sixth grade does not provide enough problem drill to justify extensive use of calculating machines. Further investigation will probably be conducted on a higher level."

Harap and Barrett (44) undertook to discover whether fundamentals could be learned in an arithmetic activity program for Grade III in which integers are studied. Ten activity units were covered in the year. The Los Angeles Diagnostic Test in Fundamentals of Arithmetic gave an average grade score of 4.1. Harap and Barrett said, "These results confirm our earlier findings that the fundamentals can very satisfactorily be learned in a program of arithmetic units based on real situations in which arithmetic is learned as it is used, not before it is used." The direct and indirect methods of teaching the addition combinations were studied by Breed and Ralston (5). The controlled experiment procedure was used in Grades I and II. Tests used were the Otis Group Intelligence Scale, the Buswell-John Addition Test, and an Initial Combinations Test (non-standardized). In Grade I the Courtis Standard Research Test, Series A, was also administered. Results show that the indirect method is better in complex addition and as good or better in addition combinations.

Brownell and Watson (7) conducted an experiment on the comparative worth of personal interviews and the analysis of tests as diagnostic methods in arithmetic. The test used was a modified form of the Brueckner Diagnostic Test in the Addition of Fractions. Results showed that the personal interview and the analysis of tests were about equally effective in identifying the total number of faults for the entire group. When the diagnosis.

is that of the difficulties of individual children, the personal interview is both more reliable and more valid. Feder (29) attempted to determine the effect of directions, and arrangement of items, on student performance on the number series test of the Mathematics Aptitude Test, Form X, of the Iowa Placement Examinations. Three forms were constructed. One was the original, another retained the original order with improved directions, and a third was a power test with original directions. Results led to the following conclusions: (a) clear-cut directions are superior to longer, more detailed explanations; (b) when arranging items in order of difficulty, care should be taken that items are not grouped according to common basic principles which are not found in succeeding groups.

Grossnickle (41) reported a study involving concepts in social arithmetic for the eighth-grade level. A list of 68 mathematical concepts in the business usages of arithmetic found in a majority of 13 different textbook series for the seventh and eighth grades were incorporated in a four-response multiple-choice test. The tests were administered to 1,337 pupils completing the eighth grade in 8-4 plan schools. The level of attainment in mastery of concepts in most schools was about the same; in only one school was the average attainment more than two-thirds the total possible score.

Gundlach (42) conducted an experiment with a twofold purpose: (a) to give information concerning the nature of the curve of growth in ability to work types of examples in common fractions for pupils in Grades VII to XIII, inclusive; and (b) to determine to what extent the factor of mental capacity affects the curve of growth in ability of pupils of the secondary school to work types of examples in the operations of common fractions. Gorman (37) administered a 215-item test of arithmetic vocabulary to 92 teachers in Grades I through VI, and to thirty students enrolled in a class in the teaching of elementary arithmetic. He found a significant difference between the arithmetic vocabularies of experienced teachers and students in elementary education, and that a significant proportion of both teachers and students manifest a lack of understanding of a number of important signs and abbreviations in arithmetic, and both need to improve in the ability to define in simple language many of the basic concepts.

Achievement in English

Traxler and Anderson (89) gave two forms of an essay test in English to high-school pupils in a carefully controlled situation. The papers were scored by two individuals. Results showed that the reliability of the reading of the papers was high, but that the reliability of pupil performance was relatively low.

Wagner and Strabel (91) attempted to determine what measures, available at college entrance, best predict subsequent performance in English. Grades in high school and on New York Regents' examination, scores on

the American Council Psychological Test, the Iowa High-School Content Examinations, the Cooperative English Test, and the Nelson-Denny Reading Test were studied. General conclusions seem to be that "college English performance may be predicted about equally well by a measure of secondary school English, a secondary school language, general high school performance, or the Cooperative English Test. Vocabulary seems especially important for success of boys; general information for girls."

Lowen (51) reported an experiment in which she attempted to leave environment as the one variable affecting the output of poetry by two groups of children. Environment was judged by Sim's Score-Card, home visits, and the principal's survey. Lowen said, "In this experiment environment made no appreciable difference in the quality of poetry produced."

Netzer (60) was concerned with an attempt to evaluate pictures, incomplete stories, and objects as stimuli for oral language. Responses of fourth-, fifth-, and sixth-graders were recorded electrically through microphonic equipment. Subjects responded best to objects, next to stories, and third to pictures. An attempt to rate the compositions on the Thorndike Extension of the Hillegas Scale proved unsatisfactory with the result that oral composition scales were developed.

Garnett (32) reported a study of the status and improvement of college freshmen in certain skills in English composition. Six tests were administered in three teachers colleges. The author concluded that "only a small number of students are adequately prepared for the high art of teaching the basic skills in written English."

Achievement in Foreign Language

Wrightstone (99) reported that the scores of 125 pupils taught according to newer type practices were superior in Latin to those of pupils who had been taught according to standard practices. The superiority, however, was not statistically significant. De Sauze (15) reported the results of the American Council French Test and parts of the Cheydeur French Test administered to students in the Cleveland schools where the teaching of foreign language involves a multiple or eclectic approach. Results of the reading versus the eclectic method showed the latter to be superior in Cleveland schools for the second and fourth semesters in total achievement and also when the silent reading scores alone are considered for fourth-semester pupils.

Stalnaker and Kurath (80) constructed two twenty-minute tests in German vocabulary which are claimed to be highly reliable. One was a best-answer recognition test and the other a context recall test. Results of administration to 184 students in elementary German showed the context test to be slightly more reliable and to be preferred by a slightly greater number of the subjects as a fairer test. Both tests appear to measure very nearly the same abilities.

Measurement of Spelling Ability

Northby (62) compared five types of spelling tests for diagnostic purposes. Twenty words were selected from the Iowa Spelling Scales and administered to forty-three sixth-graders in story form, timed dictation, list form, multiple choice, and orally. Timed dictation and story form were most difficult, and multiple choice the easiest; the list form appears best for diagnostic purposes. Stuit and Jurgensen (82) conducted a similar experiment with freshman students at Carleton College. The Cooperative English Test calling for the identification of 53 misspelled words in eight themes, and a dictation test presenting these same 53 words were administered. Students had a tendency to score higher on the dictation test. The authors concluded, "All factors considered, it seems that a test requiring a student to write dictated sentences would be more valid as a test of spelling ability."

Growth in Handwriting

Conard (11) studied the influence of manuscript writing and type-writing on the development of 150 children in the second, third, and fourth grades. Results of other subjects were noted. The manuscript tests were scored according to Conard Manuscript Writing Standards and one point was deducted for each typing error. "As a result of the study . . . it appears that the typewriter is influential in developing the children's creative writing, does not affect handwriting detrimentally, but appears to stimulate both quality and speed in handwriting, and has a minor influence on other subjectmatter." Goetsch (35) was concerned with the effect of the shift from manuscript to cursive writing upon the pupils' writing and composition in the intermediate grades. Cursive writing was taught in all grades of control cities; manuscript in Grades I and II, and cursive in Grade III, of experimental cities. Specimens were analyzed according to the Kansas City Scale for Measuring Handwriting and the Nassau County Supplement of the Hillegas Scale for Measuring the Quality of English Composition. The data showed no evidence that either type of early training leads to a better quality of composition in the later grades.

Achievement in Science

Buckingham and Lee (9), using true-false tests and organization tests in natural science, showed that college freshmen may use memory alone to secure high scores on a true-false test and still be unable to see the relationship between items and a central thesis. They suggested that it is necessary to go a step beyond the objective testing of correctness alone to meaningful organization. In a similar study, Downing (23) devised a test to measure skill in the use of some of the elements of scientific thinking and the safeguards that are needed. Fifteen questions were administered to over 1,000 pupils in Grades VIII through XIII in science classes only. Conclusions are "that ability to think scientifically is a complex of a number of component

abilities and that these develop at varying rates and differently in different communities."

Peterson and Douglass (70) compared the results of using published workbooks with pupil-made notebooks in general science. Pupils were paired on the basis of the Otis Group Intelligence Test, chronological age, and scores on an objective test given at the beginning of the year. Progress was measured by assignment tests over units of the course, an objective test at the end of the first semester and at the end of the third semester, and the New York Regents' examination in general science. During a second year the Ruch-Popenoe General Science Test was administered as an initial and final test. Although there were only two significant differences in favor of the notebook method, six other differences favored this method. Ruch-Popenoe results, although not yielding a fully reliable difference, favored the workbook section.

Gutzeit (43) reported the results of teaching an abstract concept in science by means of the motion picture. The controlled group technic was used. Ten-minute tests over elementary molecular and atomic theory were constructed. Results showed subjectmatter to be within the conception range of the eighth grade. The tests were too simple and brief to gauge the effectiveness of teaching, however.

Rosenlof and Wise (75) compared the relative achievement of pupils in courses in physical science and in physics and chemistry on the basis of three different factors. Pupils were paired on the basis of the Otis Self-Administering Test of Mental Ability, Noll's What Do You Think Test, and a comprehensive physical science test devised for this study. This latter test was also used as a final test together with the Cooperative Physics Test, and the Cooperative Chemistry Test. The authors felt that as a result of this study a fusion of physics and chemistry is possible and desirable.

Dickter (17) studied the relationship between scores on the scholastic aptitude test and college marks in chemistry at the University of Pennsylvania. The author concluded that results on the mathematics section showed enough promise to warrant its continued use in the scholastic aptitude tests.

Burnett (10) reported the results of an experiment in the problem approach versus the recitation method in the teaching of biology. The Hoff Scientific Attitude Test was administered at the end of six weeks, the Ruch-Cossman Biology Test at the end of twelve weeks, and comprehensive formal objective tests at the end of each unit. Results favor the problem approach throughout. Another study of teaching methods was made by Douglass and Fields (21) who compared the merits of the daily assignment-daily recitation and the unit assignment methods of teaching high-school chemistry. Results of the Powers General Chemistry Test and an experimental test of high reliability led to the conclusion that neither

method was distinctly superior and that factors other than method were responsible for differences in final scores.

Achievement in Social Studies

Reilley (73) conducted an experiment in an effort to determine the interest of high-school seniors in politics. Tests were constructed from material of current newspapers and magazines. The tests were administered to seniors and also to freshmen in a school where the development of political interests had been one of the objectives of the social studies course. Results show that an interest in political matters may be developed if the school authorities make definite provision for it.

Herrick (46) proposed certain instruments for the evaluation of pupils' thinking concerning current social questions. Although at the time of his article the tests had not actually been tried in the classroom, the author believes that if a high correlation is obtained between the pupils' ability to judge the soundness of the arguments of others, and their own position in using sound arguments, the proposed instruments may be a valid means of measuring the quality of one aspect of a pupil's thinking.

The value of the Stone Reading Test, the Otis Group Intelligence Scale, Advanced, and the Wesley Social Terms Test as instruments for predicting achievement in United States history was investigated by Bolton (4). The Wesley Test was found to be significantly better for purposes of prediction than either of the other two.

Congdon (12) studied papers written for entrance examinations to 26 colleges, in an effort to ascertain the differences in achievement in geography, civics and history, and general science, between students from different sections of the country, and from rural and urban populations. Results show that geography and general science are affected both by locality and population; differences for civics and history are not statistically significant; locality exerts the greater influence on geography, and rural-urban status upon science.

Douglass and Pederson (22) reported an experimental study to determine the value of large units versus daily assignments in eight sections of American history in high-school classes. Initial tests were devised by the experimenter. Twelve weeks of instruction were followed by an objective test devised by the experimenter, and the Iowa Every Pupil Test in American History. Results seem to point to the superiority of the large unit plan.

Park and Stephenson (66) studied the value of visual aids in teaching language arts and social studies. Two groups of Grade VIIB pupils, fifteen in each group, were administered a fifty-item objective-type test over the unit to be taught. Progress during the experiment was checked at regular intervals by job tests. Results of final tests show that visual aids are

worthwhile and that a close correlation of language arts and social studies and literature make for a better understanding and appreciation of the material.

Music Ability and Achievement

Ross (76) found 428 Indian children in Grades VI through XII to be inferior to white children on the Seashore Music Talent Test. Japanese children, however, compared favorably at all grade levels with the white children.

Dean (16) used the Seashore Musical Talent Tests and the Terman Group Test of Mental Ability to determine their value in predicting the success of entering students in the Eastern Montana State Normal School in required courses in sight-singing and ear-training. Results show that intelligence is not as important as prior musical training and that the Seashore tests of pitch and memory were most predictive. Farnsworth (28), after attempting to determine the relative values of music capacity tests and intelligence tests in the prediction of music grades for college students, concluded that "music capacity and intelligence tests have variable potencies in the prediction of music grades." He calculated correlations between the Thurstone Psychological, Iowa Placement, Seashore Sense of Pitch, and Seashore Tonal Memory tests, and grades in music theory, and history and appreciation of music. Lamp and Keys (50) conducted a somewhat similar experiment to determine whether or not aptitude for specific musical instruments can be predicted. The Terman Group Intelligence Test and the Seashore Tonal Memory and Pitch Discrimination Tests were administered and certain physical measurements were taken of 151 ninth-grade pupils. Conclusions are that the Seashore Tests do not yield an index of aptitude for brass, woodwind, or stringed instruments adequate for individual guidance. The predictive value of the Terman test is even less. Teeth evenness and length or slenderness of fingers bear no appreciable relationship to performance. A combination of measures, however, proved to be of sufficient predictive value for the brass horn to be of use for guidance purposes.

Rigg (74) was interested in the relationship of discrimination in music to discrimination in poetry. Seventy-one college men were given the Oregon Music Discrimination Test, the Rigg Poetry Test, and the American Council Psychological Examination. Intercorrelations were low.

Teaching Conditions and Achievement

Eastburn (25, 26) reported studies of the relation of class size and the efficiency of instruction. English and history were the subjects considered in an early investigation. Pupils were paired on the basis of the Terman Group Test of Mental Ability, the Columbia Research Bureau American History Test, and the Columbia Research Bureau English Test. Grade points, age, and sex were also considered. Initial tests given to groups

were the Columbia Research Bureau American History Test, the Iowa General Information Test in American History, the Columbia Research Bureau English Test, the Iowa Placement Test in English Training, and the literature section of the Iowa High-School Content Examination. Different forms of these examinations were used as final measures. The Hand-Carley Student Reaction Form was also administered. Results of this study and of a later investigation employing similar tests led to the conclusion that "since some teachers can handle large classes as effectively as small classes, it becomes the responsibility of the school administrator to determine which of these teachers can teach large classes effectively and in what subjects and on what ability levels."

Crawford and Carmichael (14) reported the results of a study involving three years with home study and three without in Grades V to VIII. Results on the Stanford Achievement Test revealed no significant differences, although pupils without home study showed a significant drop in high-school marks.

Herr (45) conducted an experiment in which 97 junior high-school pupils were allowed to reduce the three-year course to two. Evaluation was made by administering certain standardized tests to three senior high-school classes and comparing the experimental with the control groups. The Columbia Research Bureau Tests in Plane Geometry were administered to the sophomores; the Columbia Research Bureau Tests in Chemistry and American History to the juniors; and the Purdue Diagnostic English Test and Peters' Test of General Information were used with the seniors. Results show that "so far as scholastic achievement in senior high school is concerned, no outstanding differences in the achievement of the two groups are found. . . . It must be noted, however, that the measures for which the differences are significant, are in favor of the rapid progress group." Other factors studied were extra-scholastic activities and social adjustment, which showed no significant differences.

Morgan (58) was concerned with evaluating the seminar method in a course in elementary educational psychology for superior students. Two control groups and an experimental group were used. Matching was done on the basis of the Thurstone Psychological Test and results of a final examination in elementary psychology. The final examination in educational psychology showed a tendency for the experimental group to be superior.

Wrightstone (100) provided comparative data between newer- and standard-type public schools, at the elementary, upper elementary, and secondary levels. Results were reported by the author which indicated that "newer type practices will produce equal if not superior achievement in desirable skills, knowledge, attitudes, personal and social adjustments, and character traits."

CHAPTER II

Educational Prevention, Diagnosis, and Remediation¹

FRED P. FRUTCHEY

THE MOST IMPORTANT use of evidence concerning the mental, social, emotional, and physical behavior of boys and girls is to aid in developing an understanding of them. Teaching may be based upon valid evidence, carefully collected and wisely interpreted, or it may rest upon a series of untested assumptions, poor guesses, and wishful thinking—or some degree between the two. Teaching which is carefully related to the future as well as the present development of boys and girls must have a careful factual basis, including not only cross section data but also long-time records. As Lefever (123) said, "Without a definite basis for determining the nature and extent of the child's growth, educational planning will be reduced to sheer guesswork."

There has been some emphasis in the literature upon prevention, rather than upon remediation. For the purposes of the present chapter, however, we shall not be concerned with the distinction, since we are here giving attention primarily to the fact-finding and appraisal aspects which underlie prevention, diagnosis, and remediation alike.

The general desirability of using tests at the beginning of the school year in order to understand pupils and to be able to provide appropriate educational experiences was described by Chase (107). Tyler (133) and Lee (122) dealt at greater length with the close relationship of evaluation to the curriculum. Newland and Ackley (125) commented that guidance should rest not only upon the diagnosis of failure and subsequent reconstructive measures but also upon constructive measures in the prevention of failure.

The most significant treatise on educational diagnosis which has appeared in the last three years is the *Thirty-Fourth Yearbook of the National Society for the Study of Education* (124). The yearbook contains chapters dealing with factors associated with learning difficulty. One section is devoted to the principles and technics of educational diagnosis and treatment. Two chapters by Tyler (132, 134) discuss ideas fundamental to any diagnosis or inventory. Two sections are devoted to diagnosis in reading, English, arithmetic, social studies, natural science, health education, behavior disorders of children, speech, vocational interests, abilities and aptitude, musical talent, art, leisure-time activities, and creativeness. The final chapter by Stenquist (128) takes up the administration of a program of diagnosis and remedial instruction.

¹ Bibliography for this chapter begins on page 558.

Clarification of Objectives

A more exact diagnosis in education rests upon a greater clarification of the important intangible objectives of education by identifying and describing types of behavior characteristics of each of these objectives. The study by Rankin (126) on creativeness is especially valuable because it illustrates how an intangible objective can be made concrete and meaningful through the specifying of areas of activity and characteristics of behavior. Hartung (120) described aspects of the ability to interpret data. A clarification of social sensitivity, an important objective of the social studies, was presented by Taba (130). A bulletin by Fawcett (112) illustrated some characteristics of behavior involved in an understanding of the nature of proof—a mathematics objective. Dale (108) discussed diagnosis in leisure-time activities. In diagnosing reading skills and abilities in the elementary school, Wrightstone (143) presented a chart showing a list of reading deficiencies, their probable symptoms and remedial treatments. Witty and Kopel (137) reported an analysis of the difficulties of poor readers. Thompson (131) analyzed information test results into areas of content. These studies illustrate the clarification and analysis of general objectives into subobjectives and characteristics of behavior which are to be treated in a remedial procedure.

Devices for Gathering Evidence

An examination of the literature indicated that many types of devices were used in diagnosis. Various writers (134, 144) pointed out the need for different devices. Davis (109) used checklists of behavior characteristics relating to reading and other types of behavior. Strang (129) used a student's own analysis of how he reads a problem as a means of obtaining some insight into his mental behavior. Various instruments to test vision, hearing, phonetic aptitude, and other kinds of physiological and psychological tests were employed.

Significant contributions in the uses and interpretation of test results as a basis for remedial instruction are being made under the direction of R. W. Tyler by the Evaluation Staff of the Progressive Education Association's Commission on the Relation Between School and College. Although reports of this research have not appeared in the literature up to the closing of the bibliography, they should be mentioned here because they deal with the analysis of various characteristics of behavior which represent a general objective. Interpretations of test results are made in terms of kinds of behavior as well as in terms of areas of subjectmatter.

Diagnosis in Reading

Many of the reported studies contributing evidence of results of remedial and corrective instruction in the school are in reading. These studies reflect concern about the relation of pupil interests, rapport, pupil recognition

of attainable goals, extensive reading, and teacher points of view to remedial reading instruction. Witty and Kopel (141) used pupil interest in selecting reading materials and planning a reading program. They stated, "From indifferent, fearful, and unhappy youngsters most have changed into interested, alert participants in numerous school activities." They believed that the changes brought about were not only the results of methods used but also of the point of view of the teachers, "... a sympathetic understanding of children and a sane attempt to meet their legitimate needs." They had objective records of increased amount of voluntary leisure reading and a more intelligent and frequent use of books and library facilities. Witty and Kopel (140) further reported that "at the beginning of the work about one-third of the poor readers approached any reading task with trepidation. The change in attitude when attainable goals were sensed brought about a personality alteration not readily describable in objective terms."

In using an extensive reading program in remedial teaching, Ansley (101) found that an experimental group gained in comprehension the equivalent of one year more than a control group. Anecdotal records of the pupils' interests in reading showed desirable shifts. Garrison (113) reported a variety of testing methods used in a remedial approach based upon pupils' interests and extensive reading. Gains in rate and comprehension and greater interest in reading were found. Brooks (105) concluded that the point of view of the teacher in creating and encouraging a desire to read is an important part of remedial work.

The data from intensive studies of remedial reading in New York City led Gates (116) to believe "that at least four out of five deficiencies in reading result from failure to recognize the individual pupil's failure and difficulties which crop out from day to day." A teacher must be alert and sensitive to behavior symptoms during the busy day of teaching. He claimed that investigations have been too much concerned with reading as an isolated activity.

Burk's study (106) of factors in the style of composition showed that fourth-graders are most interested in stories containing short simple sentences, and least interested in stories written in long complex and compound sentences. Long and complex sentences, however, have no effect on comprehension, and produce the highest rate of reading. Fourth-graders prefer stories containing direct conversation. Highest comprehension and rate of reading were obtained with stories using direct conversation. The writer pointed out that these are "rounded off" generalizations, not sharply supported by the data in the study.

In the diagnosis of reading difficulties it is important to identify and eliminate physiological disabilities in planning a psychological approach. Witty (139) pointed out: "In every case of reading disability search should be made for visual difficulties. Such examination is a vital item in the comprehensive individual diagnosis which should precede remedial

endeavor. It is clear that the cause of reading disability (as an entity) lies in no single visual factor."

Effect of Diagnosis and Remediation upon Teachers

A remedial program may produce desirable changes in the attitudes and points of view of teachers. Deady (110) stated that in the minds of teachers their diagnostic and remedial teaching program has transformed "grades" into "boys and girls." Eurich (111) stated that "the improvement of examinations stimulates instructors to become critically aware of the specific objectives and outcomes of their instruction and leads to changes designed to improve both selection of subjectmatter and methods of teaching. It compels the instructor to think of numerous illustrations of the way in which his instruction changes student behavior." A fundamental principle of diagnosis and remedial instruction relating to the point of view of the teacher is that conclusions drawn from research results become promising hypotheses when applied to an individual boy or girl (132): A competent diagnostician thinks of them as a tentative working basis subject to modification as new facts come to light.

CHAPTER III

The Essay-Type Test¹

CHARLES C. WEIDEMANN and BIRDEAN J. MORRIS

Limitations of the Essay Test

LACK OF RELIABILITY of scores was pointed out by Holroyd (148) as the first defect of the essay test. The reasons given for the unreliability of scores were the lack of objectivity and the influence of such factors as English construction, spelling, penmanship, neatness, arrangement of form, sympathy for the hard working but slow student, general improvement, and personal attributes on the grade. Other criticisms were: (a) restricted usefulness with almost no opportunity for diagnosis; (b) encouragement of cramming; (c) little basis for comparison between students or classes; (d) encouragement of bluffing; (e) consumption of an overshare of students' and instructor's time; (f) lack of any known formula for correction of guessing, as in objective examination; and (g) the restricted range of material that can be tested in a given time.

Criticisms of the essay test as used by many English teachers were listed by Stalnaker (157). The first objection is that teachers try to teach the pupil to write charming bits of nonsense on subjects of no interest to him instead of aiding him to express himself clearly and accurately within the range of his interests and abilities. Another weakness is the vagueness in the instructions given the students. The essay test is rarely read with a reliability of over .60, when it should be read with at least a reliability of .90. Explanations offered for this inconsistency in the rating of essay tests or themes were: (a) disagreement among masters in English on what constitutes a good theme, (b) the influence of the reader's physical condition on his grades, (c) the objection to grading a theme high, and (d) the traditional use of optional topics. Kandel (150) offered as his objections to the essay examination the unreliability of scoring and the time involved in the construction and marking of the tests. Wrightstone (160) objected to the essay tests on the basis of (a) time-consumption, (b) narrow range of information tested, and (c) unreliability and subjectivity variations in grading.

One of the real limitations of the essay test in actual practice may be that it is not measuring what it is assumed to measure. Doty (146) analyzed the essay test items and answers for 214 different items prepared by teachers in fifth and sixth grades and found that only twelve of these items, less than 6 percent, "unquestionably measured something more than recall." Doty set up a number of criteria for determining whether the answers involved a significant amount of reorganization of knowledge,

¹ Bibliography for this chapter begins on page 559.

or whether they involved only direct memory. Some of his conclusions were: "That a test item is essay in form gives no assurance that it is essay in fact. . . . The essay-type test used in the classroom measures memory more often than it measures any other mental process. . . . Teachers are not measuring all of the objectives of instruction which it is desirable and possible to measure" (146:30-31).

Values of the Essay Test

The essay test has been named as the only valid test of ability in written composition and as the best measure of artistry of effort in expression of thought (148). Other merits attributed to it were: (a) ease of construction and administration, (b) shortness of time used in construction compared to time taken for objective test, and (c) questions can be written on the blackboard, saving both labor and materials as compared with tests requiring mimeographing. The essay test has values for advanced students because: (a) it reveals reasoning procedures, originality, and initiative; (b) it tests ability to organize; (c) it offers opportunity to exercise discrimination and judgment; and (d) it allows for interpretation of thought.

Makers of objective items frequently argue that such items call for thinking and problem solving just as definitely as do essay tests. Jones (149) attacked this claim, pointing out that a large number of the objective items examined revealed very few predominantly thought questions. Most of the items were concerned with definitions, memorized formulas, dates, and proper names. Jones added, "When we are ready to give as much time to good essay examining as we now are giving to objective forms of examining in many centers, we will doubtless strengthen our college education considerably."

Wrightstone (160) said that essay questions may be defended for measuring certain objectives. The objectives named were: (a) an attitude toward some social, political, or economical phenomena; (b) the organization of social studies facts; (c) the interpretation, evaluation, or discussion of social studies facts and data; and (d) an application of social studies principles to described events or situations.

One type of defense for the essay test is to attack the reliability of the objective test. Pullias (153) after a thorough study which is of far-reaching significance concluded that: (a) tests may be objective in the sense that all personal opinion is eliminated in scoring and still fail to remove important personal elements from the evaluation of pupil achievement, (b) measures of pupil achievement obtained from different informal objective tests may be expected to vary to a considerable extent, and (c) pupil ratings based upon standardized test scores show marked disparity. Pullias based his conclusions on the analysis of 6,200 teacher-made objective test papers given to 3,100 pupils, and upon 1,380 standardized test batteries given to 460 pupils, in the fifth and sixth grades of public school systems.

Comparison of Mental Functions Measured

Meyer (151, 152) directed one group of students to prepare for a true-false test, a second group to prepare for a multiple-choice test, a third group for a completion test, and a fourth group for an essay test. He then gave each of these groups all four types of test. He found all four types of test equally good for the measurement of recalled facts, but found that the completion and essay tests gave higher scores for a later testing of the same students. Seeking evidence on the methods of study employed by the four different groups of students, Meyer obtained statements from them, and also examined their markings in the books they had studied. He concluded that students studying for the objective tests tend more to the (a) underlining of words, phrases, and sentences; (b) listing of names, places, dates, and numbers; and (c) framing of practice test questions. Those studying for essay tests tended toward the (a) making of summaries in paragraph form, (b) drawing of maps, and (c) taking of random notes.

The type of material learned varied in accordance with the method of study. Students who were preparing for objective tests tended to (a) learn facts, (b) memorize statements, (c) put emphasis on details, and (d) learn definitions, words, and figures. Pupils studying for the essay test attempted to (a) get a general view of the material, (b) form personal opinions, (c) interpret material, and (d) fix the general outline and then add the details. When studying for an objective test, a student said, "I stuff my memory with as many facts as I think it likely to retain for the required time, until and including the test, and then quickly forget everything except the few points that appealed to me as most important."

Jones (149) stated his belief that instructional emphasis and the student's own efforts are almost certain to follow in the trail of the principal methods of examination used in a school. If emphasis were laid on factual details, the student would naturally turn to underscoring correct items or to listing points on memory cards. If students were graded on the quality and substance of their essays, they would try to improve in this respect, and examiners would take more interest in aiding development along this line. Jones contended that the essay examination still holds the attention of the average professor in the field of social science or the humanities. "He is more interested in a whole examining picture, a *Gestalt*, than in separated examining objectives. He is willing to have many facts omitted, but he wants the student's own organized expression, for without expression education is meaningless and the whole mechanism of instruction becomes pedantry" (149:202).

Jones (149) reported that, in answer to the statement, "I think one's ability is far better shown through discussion questions than through short objective questions," 68 percent of the students in colleges which give senior comprehensives, and 55 percent of the superior students in other colleges, answered positively. Alumni taking both types of examinations

offered even more favorable comments on the essay test. The alumni favored the essay because they felt that it was more important to be able to discuss an issue than merely to check it. From a survey made of the examination system of Harvard College, Hanford (147) stated undergraduates favor the "reasoning, speculative type of examination questions."

Hanford (147) held that questions challenging opinion, presenting a problem, or calling for critical comment, lend themselves to the essay method of discussion. In speaking of the General Examination System of Harvard College, he stated that the examiners prefer the essay test which involves analysis and explanation, opinion, or evaluation of propositions. The essay test has been found by them to be suitable for (a) measuring the student's ability to use and correlate knowledge, (b) discovering how far the student has grasped the meaning of the material studied, and (c) discovering the use the student can make of the material.

Kandel (150), offering an argument in favor of the essay type of examination, said that the essay test provides better evidence of the understanding, reasoning, and ability to organize information than do objective tests. An experiment was performed to find the results of the essay and objective test given in the same subject, United States history, to the same pupils. According to these data the essay test proved to be slightly superior to the objective test as an instrument for measuring understanding. Stewart (158) concluded that well-chosen essay-type questions give a teacher a knowledge of the pupil and an understanding of his thought processes that cannot be obtained by any other means.

Raths (154) listed the major objectives of the thirty schools in the eight-year project of the Progressive Education Association. These objectives were classified under eight heads: (a) thinking; (b) interests, aims, and purposes; (c) attitudes; (d) study skills and work habits; (e) social adjustment; (f) creativeness; (g) functional information, including vocabulary; and (h) a functional social philosophy. Of these eight, four called for the use of the essay test, namely, the first, fourth, seventh, and eighth.

Suggestions for Improving the Essay Test

Holroyd (148) suggested that the technics of the essay examination be refined and used in composition exercises and for tests of reasoning, judgment, organization, and appreciation in the case of advanced students. It was further suggested that the essay test be used with other tests, permitting (a) a wider sampling, (b) greater objectivity in scoring, and (c) a comparison of standards. For solving the problem faced jointly by the English teacher and test technician, Stalnaker (157) suggested constructing a test which would test the permanent writing skill of the student. The first step was to make clear what abilities were to be measured. One exercise should not attempt to measure all the abilities; each ability should be measured separately. Short exercises are advised so that there will be examples enough for a dependable measure. Questions should not

be formulated to inspire the students since the object is not to test his inspired creative genius but his consistent underlying ability to express himself. Stalnaker described tests which purport to measure the student's knowledge of grammar and general mechanics and at the same time afford a rough measure of the student's writing ability. The first-mentioned test is the construction-shift test in which a sentence is given the student and he is told to make in it a specified shift in structure. Though not strictly an objective test it is read with a reliability of .98. Two other types are mentioned which can also be read with a high degree of consistency. In the first of these, verbose sentences are to be reduced to as few words as possible without sacrificing essential ideas. The other test consists of short, choppy sentences to be rewritten into a smoothly running paragraph without changing organization or ideas.

Wrightstone (160) said that the essential step in improvement was the omission of questions that test mainly recall of information. He further suggested that the examiner determine the objective or objectives to be measured and devise appropriate questions for each objective. For the scoring of such questions as those asking the pupil to describe, compare, contrast, explain, interpret, discuss, develop, evaluate, and summarize, he suggested the use of scaled samples.

Scoring the Essay Test

Meyer (151) tried grading answers to essay tests in three ways: (a) giving points for correct facts called for, (b) giving additional points for correct facts supplementary to those required, (c) giving additional points for organization. When grading on facts, one point was allowed for each correctly stated fact that was pertinent; organization was rated on a ten-point basis. Intercorrelations between total scores ranged from .83 to .91.

Stalnaker (155) believed that the essence of measurement is objectivity. He referred to evidence that the readers of the College Entrance Examination Board tests can grade papers with reliabilities of over .90 and in some instances over .98. For tests of composition ability, he would eliminate the use of letter grades with absolute literary significance. The exercises should be evaluated with points for definite elements which competent teachers judge to be significant. He felt that such methods would produce reliabilities as high as .95 without a sacrifice in validity. Stalnaker (156) believed also that the use of optional questions is a cause of unreliability in grading essay tests. He said, "Asking all students to run the same race is a feasible step in improving the essay examination."

Possible improvements in the marking of essay tests were offered by Wrightstone (160). The examination should be planned to measure one defined objective of instruction, such as an attitude or interpretation of facts, for which no valid and reliable objective test is available. A definition of the objective should be accepted by all the readers of the examination, and certain standards of measuring values should be agreed

upon by the readers. If the teacher wishes to include several objectives, such as pupil's organization of facts, social attitudes, and neatness, the paper should be graded for one purpose at a time and the grades assigned separately. The teacher or teachers grading the papers should first decide upon the aspect to be marked, then an ideal answer should be formulated, and each part assigned a certain number of points. Wrightstone recommended an eleven-point scale for grading, from 0 through 10.

Regarding the examinations, largely essay, used at Harvard College, Hanford (147) stated, "Through the preparation and grading of the examination by the same persons, by constant and intimate consultation regarding line cases, and by means of the oral examination as a supplement to the written examination for line cases, an attempt is made to obtain reliability and validity of the examinations." According to Thurstone (159), the essay test should be restricted to one or two pages. He suggested that grading can be improved if done with reference to a predetermined list of ideas which shall be regarded as acceptable in the replies and perhaps still other ideas that shall be regarded as not acceptable. Kandel (150) said that it is possible to mark essay examinations with a reliability of .80 or over; they are usually marked with reliabilities from .30 to .50, and .70 or over is rare. Methods should be used to restrict answers to specific questions, and Kandel offered the same suggestions on procedure as those already adopted by the Regents' or College Entrance Examination Boards. These suggestions are: (a) agreement on what questions should be marked for, (b) analysis of an ideal answer, and (c) assignment of a certain number of points to each significant part of a question.

Summary

More use of improved forms of the essay test along with objective tests is recommended in order to attempt a more comprehensive measurement of differing mental functions. Much research is needed to indicate how the essay test may be improved. Almost no literature touches the problem of validity of the essay test. No studies of the "Form A-Form B" reliability of the essay test along lines similar to "Form A-Form B" consistency determinations of objective tests are available. The problem of scoring essay and objective tests is not that of developing a high consistency correlation between two sets of essay scores, or a high correlation between essay and objective test scores over the same material, thus reducing the essay to a form measuring approximately the same mental functions as the objective test measures. The problem involves a low correlation between essay and objective test scores over the same material with high consistency coefficients. Under these conditions each test type would measure mental functions unique to its type and thus decrease the overlapping of the mental functions measured. It seems probable that there is a definite place, need, and use for improved forms of essay tests in the secondary and college levels of learning.

CHAPTER IV

The Improvement of Classroom Testing¹

DOUGLAS E. SCATES

THE IMPROVEMENT of classroom testing seems to lie in the following three directions: (a) a more carefully considered set of purposes for which testing is done; (b) a greatly broadened and enriched set of outcomes which must be measured; and (c) the development of instruments appropriate to the newly created needs. The discussion of these three movements practically fills the testing literature, crowding out much of the former concern over such questions as old-type vs. new-type tests, true-false vs. multiple-choice tests, or instructions to guess vs. instructions not to guess, which until recently held the center of interest. The present concern is with more fundamental issues; the novelty of objective and standardized testing has passed, the surface attractiveness of carefully printed instruments has worn off, and those workers who are now leading the thinking are searching the testing movement to ascertain what fundamental values are there, and what changes can be made to make tests a stimulus rather than a hindrance to further educational progress.

The literature dealing with such topics is primarily of the analytical, argumentative type, based on experience and observation. The problems in such areas do not lend themselves readily to formal research. The present summary will accordingly be made up chiefly of discussion material, with supporting research where available. The present treatment does not deal, except incidentally, with tests of intelligence, personality traits, and the like, as these were covered in the *Review of Educational Research* for June 1938. The term "testing" is used in the broad sense which it is gradually coming to have, including, by implication, all systematic means of gathering evidence on pupil performance.

Changes in Teaching and in Testing

Each generation seems to discover for itself teleological and methodological concepts which it brands as new, or progressive, even though these very ideas may have been formulated and voiced centuries or millenniums earlier. It is difficult to know what is new; most ideas are new only to individuals. It appears however that there are strong movements in education today which are actually affecting practice in conventional schools in a way which heretofore was only talked about, or practiced only in a few private schools. While it would be unreasonable to claim that vitalizing concepts of education are new, we may perhaps say that the verbal expression of these concepts has reached a new level of definiteness and specificity, in contrast to the earlier rhetorical generality.

¹ Bibliography for this chapter begins on page 560.

Contrasting the present situation with an earlier one, Wrightstone (235) stated:

When these [objective] tests were first introduced into the school program, the curriculum consisted very largely of the three R's—reading, 'riting, and 'rithmetic. At this early period in the development of both curriculum and tests, the emphasis was upon a mastery of subject matter. Teachers, parents, and pupils believed that classroom education should be mainly the memorization and recitation of assigned facts and information. The curriculum and its needs, therefore, influenced the kinds of tests which were constructed and used. It is not surprising that practically all of the earlier and older tests measured recognition and recall of isolated facts and information in separate subjects.

Progressive education has arrived at a stage of development, both in curricular practices and in testing, where new objectives and practices in education have created a need for new tests. Compared with the early curriculum and its emphasis upon information and facts, newer practices in progressive schools have created new objectives of instruction. The project technique and the integrated activity unit-of-work have opened up entirely new kinds of classroom behavior and objectives.

Other writers have pointed to the same trend. Changes in testing become necessary because of changes in teaching. Lee (193:465) commented: "Standardized tests which measured merely a knowledge of facts in literature, history, or geography were constructed for an elementary school whose central purpose was the mastery of a given body of subjectmatter. There is no more reason for using such tests today than there is for using books which were written for that type of school." Cook (175:471) stated that while "many of the earlier standardized tests . . . have tended to encourage and perpetuate this type of teaching and learning, our most competent test builders are striving with a large degree of success to construct tests which will discourage this memoriter type of teaching. The best of the newer tests avoid the use of stereotyped textbook language, require the application of laws and principles in new situations, emphasize understanding and the relationships of ideas rather than mere verbal learning, and stress the functional value of what has been learned, rather than the subjectmatter itself. Such tests are freed from the specific content of textbooks or courses of study, and measure rather the intellectual development which should be achieved through that content."

Hopkins (188), dealing with the matter in terms of fundamental, more or less philosophical, terms, pointed out that the measurement movement up to the present has been based on assumptions which grew out of "conceptions of education crystallized in America about 1900," the most important of the assumptions being:

1. A social heritage organized in subjects in which uniform learning of minimum essentials is required of all.
2. A control by the teacher of what is to be learned and how it is to be learned.
3. A fragment of subjectmatter can be adequately measured in isolation from the larger whole of which it is a part.
4. A satisfactory measure of the learning of the individual can be obtained through some form of verbal test.

After elaborating these and other points, Hopkins (188:204) concluded: "These assumptions contain no relationship to the internal balance of the individual; they do not consider the adjustment or maladjustment of the individual in his environment; they are not applicable to a variable learning situation in which uniformity has been removed both from the materials and the controls. . . . The problem of measurement . . . is to build new assumptions and technics that center measurement in the interaction of the individual with his environment and recognize desirable changes in each."

It would appear that there are at present forces which would support an advance in testing. These forces are expressing themselves in new conceptions of the relation of testing to education, and in new conceptions of what education should accomplish. We shall examine these two areas before considering directly the new tests to which they are giving rise.

Lessening Emphasis upon General Standards

The appearance of the new-type test, leading quickly to standardized forms, was a matter of sufficient moment to require a reconsideration of educational theory and the development of an educational philosophy which would incorporate the new instruments into a unified program. The last ten years have afforded gratifying progress in this direction.

In the absence of an adequate philosophy, and under the stress of increasing demands for efficiency in process and product, the natural thing to do was to emphasize standards. That was the emerging thought in industrial production; the ideology carried over into teaching. It dominated practice and thinking in the 'twenties; it has prevailed in practice during the 'thirties, and probably will in the 'forties. In the literature, however, a new emphasis has been growing.

Lee (193:465) stated that "many of the educational crimes which have been committed in the past twenty years have been due to a wrong concept of the purpose of measurement." Beers (165:578) wrote that "there appears to be no lack of interest in the giving of the tests; but what to do with the results, once they have been assembled, is shrouded in black mystery for many teachers and school authorities." We are well acquainted with the conventional uses that have been made of test results.

Wood has been one of the most consistent critics of these conventional uses. Writing in the first cycle of the *Review of Educational Research* (February 1933), he made the somewhat shocking point that raising the scores of pupils on a test, through increased learning, was not the end to be sought, that for many pupils such an increase was immaterial, and for some of them it was undesirable. He was writing of algebra, but his philosophy was general. He criticized the widespread use of tests for administrative purposes—marking, promoting, classification, credit, admission, retention—and emphasized the need for using tests for a continuous study of the individual, and for adapting both the curriculum and the instructional methods to the needs of that individual. Wood (228:9) wrote: "Tests should first of all tell

what a pupil should *try* to learn—not *how* he may be cajoled, persuaded, or insidiously coerced into learning. . . .”

Lindquist (196:73) conceded that “undue emphasis upon *average* test results, upon school-to-school and teacher-to-teacher comparisons . . . may cause the teacher . . . to neglect the interests of the pupils, and to be concerned instead with subject matter objectives and with higher average scores for their own sake.”

Other writers (182, 190, 200) joined in decrying the use of tests to enforce standards. It may be pointed out that the technical literature has contained much evidence, over a period of time, that the norms themselves, of various standardized tests, are open to considerable question. The trend of thinking seems not to have been influenced by such material, but rather by an analysis of purposes.

Putting Our Knowledge of Individual Differences To Work

Full realization of differences between individuals may be regarded as a byproduct of measurement; probably the incorporation of the facts of such differences into a working philosophy of education will be accomplished at the same time that the potentialities of measurement are assimilated. The following excerpts suggest certain uses of test results as contributing to, and as consequent upon, an understanding of individual differences.

Charles W. Eliot, former president of Harvard University, is quoted by Wood (229:229) as saying: “Uniformity is the curse of American schools. That any school or college has a uniform product should be regarded as a demonstration of inferiority. . . . Every child is a unique personality. . . . Uniform programs and uniform methods of instruction . . . must be unwise and injurious—an evil always to be struggled against.” That was in 1892.

Speaking of standards as something to be gotten away from, in the direction of individual adaptation, Wood (228:9) himself said: “Even if some do learn the prescribed minimum under the pressure of ‘remedial’ treatment, the results might not be worth the effort. Indeed, if we consider the attitudes of despair, the feelings of inferiority, the habits of dependence, the frequently temporary and superficial, if not fictitious, character of forced learning, and the loss of opportunity and time for learning something that is within the comprehension and interest of the pupil, it is not by any means certain that the efforts to ‘remedy’ children up to prescribed minimum are not positively harmful.”

Speaking on the positive side, the same writer (229: 233, 234) claimed: “We have no right to ask or encourage any pupil to learn a subject unless we have reasonable grounds for believing at least two things: first, that the pupil has the necessary ability or capacity to learn that subject; and second, that learning that subject will, all things considered, tend to make him a better and happier citizen more surely than would anything else that

he might do with his energies at that time and place. . . . The teacher's duty to learn the child is prior and paramount to the duty to teach the child. . . . The objectives of education in our public schools are accordingly: first, to try to ascertain the intellectual, personal, and social needs of each individual child; and second, to try to meet those needs, whatever they may happen to be."

Tyler made the same points: "In appraising the progress of each student adequate consideration should be given to his individual pattern of desirable educational goals. The objectives of the course do not represent points to be reached by all students but rather directions in which students may progress. . . . When objectives are conceived as uniform goals to be attained by all students, teaching tends to become an attempt to maintain a lock-step march to these goals, while testing is used to discover whether the students have reached the goals. Such a conception omits the vast array of facts regarding individual differences. Individuals differ not only in rate and methods of learning but in interests, needs, and potential abilities. How far each student may be expected to progress toward any objective varies with his needs, his interests, and those abilities of his which are involved in this progress. . . . In this sense, objectives become individualized as do teaching and learning procedures.

"It is much easier to accept the median achievement of a group of students as the goal for each person than it is to try to formulate a suitable individual pattern of goals. . . . The proper conception of evaluation eliminates purely mechanical appraisal and substitutes judgment and thoughtful consideration. This does not imply intuitive appraisal but demands valid judgments based upon the careful collection of comprehensive evidence regarding student progress" (187:13-14). For more detailed statements one may read Voelker's suggestions (225).

Adjusting the Learning Load

Connor (174:291) reported evidence that pupils who are working beyond their capacity are the chief sources of behavior troubles. "The pupils who showed the higher incidence of behavior difficulties also showed higher achievement in relation to mental ability. In other words, the slow pupil, working with a curriculum somewhat too difficult for him, tends, first, to respond by excessively hard work and relatively high achievement, and later, by other forms of less satisfactory social behavior calculated to gain attention." When the learning load was adjusted to the ability of the pupil, a more even development of character and personality throughout the pupil population resulted.

In attempting individualization, Cook (175:473) reported the determining of capacity by other than intelligence tests. "Intelligence tests are not an integral part of the testing program in the laboratory schools [of the Eastern Illinois State Teachers College], because no purpose has been found for them that is not better served by tests of achievement or of

specific aptitude." Cook recognized eight areas of special capacity, and attempted to obtain measures of capacity in each of these rather than to use a general intelligence test which represented some sort of an average of all the capacities, with an unknown weighting.

Wood (229) listed ten criteria for individualized instruction. The literature written by those not intimately connected with the testing movement contains many articles urging greater individualization of instruction.

Codified Statements of Testing Purposes

In the preceding cycle of the *Review of Educational Research* Sangren (216) listed six purposes of testing: (a) prognosis, (b) surveys, (c) diagnosis, (d) instruction (including grouping and marking), (e) experimentation and research, and (f) guidance. Raths (212) gave the following five purposes: (a) appraising specific types of achievement for individuals, for groups, and for schools; (b) reporting to children, parents, other educational institutions, and to employers; (c) appraising continuously the methods and materials employed in teaching; (d) obtaining a comprehensive picture of an individual or of a group; and (e) experimentation. The list is not exhaustive.

Jones (190), writing on achievement in literature, mentioned six purposes for evaluation:

1. Assisting the individual student more effectively to achieve, through his study of literature, the larger educational objectives with which he has identified his own purposes.

2. Making the student conscious of desirable objectives of education which may be enjoyably achieved through the study of literature, but with which he has not yet identified his own purposes.

3. Giving the teacher a clearer understanding of the student's present personal and social needs, to the end that he may more competently direct that student's future education through literature.

4. Discovering to the teacher the general backgrounds and abilities of a given class to the end that he may select with greater appropriateness the literary materials which will prove most effective in achieving the classwide objectives of education.

5. Giving the teacher a sounder basis upon which to make recommendations to others for the future or supplementary direction of the student's education.

6. Furnishing the teacher with tangible evidence that will be useful in explaining the student's literature program to interested parents.

This list suggests that the teacher is not simply teaching literature, but that he is striving to do his part in contributing to a general education, and is using literature as the medium. Measurement aids him in specific ways.

Cook (175) gave a somewhat elaborate list, the main points of which were: (a) to redirect the curriculum emphasis; (b) to provide a basis for educational guidance of pupils; (c) to encourage pupils to put forth their best efforts; (d) to direct and motivate supervisory efforts; (e) to provide a basis for the marking and promotion of pupils; and (f) to build and maintain desirable skills, abilities, and understandings. "Test

periods are considered as very effective learning periods as well as testing periods." Subpoints given under (b) are: predicting pupil performance; classifying pupils; diagnosing learning difficulties; setting up standards of pupil performance; discovering special aptitudes; discovering pupils in need of guidance and individual consideration; and measuring pupil achievement. The uses include aptitude, diagnostic, and general achievement tests; intelligence tests, as previously stated, are not regularly used.

Lee (193) listed five uses of intelligence tests, six uses of informal (teacher-made) tests, and eight uses of standardized tests. Lee and Segel (195) obtained questionnaire responses from 1,600 high-school teachers and reported that only two purposes were each listed by more than half of the teachers—to aid in determining marks and to discover topics that need to be retaught. Other uses which were frequently mentioned are: (a) to discover the quality of work a pupil should do; (b) to discover what topics should be taught; (c) to stimulate pupils to do better work; (d) to evaluate strengths and weaknesses of instruction; (e) to aid in determining the future educational program of the pupil; and (f) to classify pupils into ability groups.

Beers (165:579), writing primarily for the college level, said: "The majority of 311 colleges reporting on their most valuable experience with tests cited vocational guidance as first. . . . Test data furnish evidence for gauging the amount of class work to be carried, for encouraging superior prospects in undertaking senior college work, for making scholarship recommendations, for determining the amount of work for self-supporting students, and for stimulating both faculty and students. These and other uses indicate that testing and guidance, far from being a mere formality, serve a much felt, practical need." Referring to a certain college, he added: "Fitting education to the individual and not the conventional reverse procedure is looked upon as a major responsibility of the faculty." A digest of test uses (163) has been prepared, covering the uses reported by colleges.

Relation of Testing to Teaching

Cook (175:470) stated: "Tests are both powerful and dangerous instruments. . . . Every testing program has far-reaching effects on the curriculum, on the objectives and methods of instruction, and on the study habits of the pupils. . . . Since systematic testing tends to focus instructional effort upon the characteristics measured by the test, it is highly important that these include all the desired outcomes in instruction."

Lee (193:466) reported: "The writer has had the opportunity to observe the effects of two types of testing programs. In one case tests of facts and skills were given at the end of the year by a state department of education. In the other case tests of skills were given at the beginning of the year and were selected by the local school authorities. The first procedure resulted in cramming by the pupils and in much cheating on the part of teachers.

In the system that gave tests at the beginning of the year, the teachers were vitally interested in analyzing the needs of each pupil. There was no feeling that the teacher was being judged; the attention of everyone was focussed upon the needs of the child."

Realizing that the customary interest in comparing averages of different classes has consequences which "are unfortunate, particularly because they create in the classroom teacher an attitude toward the tests which directly interferes with the effective use of the results in pupil guidance," Lindquist (196: 72, 74) nevertheless feels that "these must be recognized as quite legitimate uses of test results," and regards the matter as a problem of the administrator and not of the test-maker. Elsewhere he stated (197:484): "The standardized test should be looked upon solely as a *measuring* instrument, and not as a teaching instrument or as an abbreviated course of study."

Stalnaker (219: 38) stated: "Fruitful theory may result from considering teaching and measurement as completely separable and independent functions. But practically tests do have a direct bearing on the curriculum. The English test which has a bad influence on the teaching of English is not a good test."

Raths (211: 91) wrote: "Emphasis should be placed on the fact that evaluation is not something that comes at the end of teaching. . . . The formal tests are to be given neither at the end nor at any specified time, but should be an integral part of the teaching. They are given for the sole purposes of diagnosing student difficulties, measuring growth, and affording teachers an opportunity to do guidance work. The exercises included in any one particular test are either similar to the ones students meet in their daily school experiences or of the kind that serve as a highly reliable index of the achievement of students in the everyday classroom situations." This position emphasizes an instructional viewpoint, in contrast to an administrative one.

Foreseeing the ultimate effects of a test on teaching, McCall and his collaborators (198: 424) reported special consideration of this point. They said: "It was important, also, that the test be scrutinized for the influence of every question upon those who would read it or give it or answer it—child, teacher, superintendent, school board, publicist—that the test be filled with suggestions for better aims, better methods, better activity, and that the language of the test suggest concrete ways of becoming better members of society, better friends, better thinkers and appraisers, better leaders, followers, and cooperators, better learners and teachers."

Brownell's regard (168) for the influence of test content upon instruction is indicated by the criteria he would employ in selecting tests: (a) Does the test elicit from the pupils the desired types of mental process? (b) Does the test enable the teacher to observe and analyze the thought processes which lie back of the pupils' answers? (c) Does the test encourage the development of desirable study habits? (d) Does the test lead

to improved instructional practice? (e) Does the test foster wholesome relationships between teacher and pupils? The last three of these are seen to stem directly from an interest in the reaction of the test on instruction, and the first two contribute to keep the teacher from being misled by the results. Brownell further said: "It should be stressed that in the practical enterprise of educating children, teaching and learning are inseparably united with measurement. . . . A test is good if it furthers sound, economical learning and advances the quality of instruction" (168: 485).

Review of Purposes of Classroom Testing

The multitude of varying claims and statements represented by the material cited present a problem of interpretation. The classroom teacher recognizes the commonsense necessity for carrying his pupils along far enough in their learning so that they can fit into the system of schooling at the end of the year. He is deluged with statements in the literature that goals, curriculums, and progress should be individualized and broadened far beyond the usual limits assigned to subjects. He cannot do everything, or please everybody. How shall he chart his course?

The answer, as indicated earlier, awaits the crystallization of an educational philosophy which is adequate for the presentday problems of education. The ultimate resolution of the conflicting interests cannot be clearly foreseen. It may be, however, that our thinking will sooner or later settle upon lines somewhat according to the following.

We have been thinking of education far too simply. We cannot continue long to ignore the facts of differences in background, learning rates, and ultimate learning levels of children, or the host of factors in their environment which affect (retard, accelerate, direct, or complicate) their learning day by day, and which may abruptly terminate their formal schooling before they have reached the limits of their mental capacity. Nor can we slight the complicating emotional factors that result in, and result from, formal learning difficulties. Such differences have been attested thoroughly, over a considerable period of time, in the educational, psychological, and sociological literature.

True, schools have tried a great many adaptations in the light of these differences. Teachers and administrators who are close to the situation recognize the great differences, and make some concessions to them. But the facts have not yet worked themselves through a consistent philosophy. It is still conventional for a school survey to compare a city school system with "the norm." Administrators still compare schools and classes and teachers on the basis of test results. Only recently the schools of a large city were listed in the newspaper in order on the basis of their average reading scores in a particular grade. We recognize differences in children when we center attention on them, and promptly drop the facts from our minds when we think of closely related matters. We still think of education far too simply.

If we are serious in suggesting individualization of goals, of rates of progress (they occur in spite of us), and of learning experiences, the administrator will have to drop entirely the whip hand he holds over the teachers in terms of comparing their classes with "the norm," with other classes, or with any other arbitrary quantity. He will have to obtain his evidence on the efficacy of instruction from other sources; or he will have to draw his conclusions from a multitude of different kinds of tests, covering a variety of outcomes such as administrators seldom think of realistically. Instead of being content with one factor—achievement—he must obtain evidence on a variety of forms of capacity, on a variety of previous and current environmental factors, on a variety of personality (emotional, attitudinal, and other) traits, and, in addition, must expand the evidence on achievement to cover a breadth of developmental aspects such as we are only slowly able to analyze out of the totality of what constitutes a well-educated person. And it seems probable that these many lines of evidence will need to be expressed as amounts of change, rather than as cross section values. An appraisal of teaching or learning that is fair to teachers and to pupils is probably too complicated for an administrator to make on the basis of test results. He should seek other means (182, 226).

Once administrators, including school surveyors, sense the complexity of education, the teacher will be freer to work out an instructional philosophy. The time has come when we should cease to be primarily interested in comparing one child with another, one class with another, or any class with a norm. We should be primarily interested in comparing each child with himself, with his past record, and with his potentialities. To center attention elsewhere is to miss the point—to miss the service which tests can render. If lateral comparisons are made as a secondary matter, they should only be given consideration when there is evidence on enough other factors to warrant a conclusion. Such evidence is not easily obtained; it requires much more than formal testing.

Large city school systems enrol pupils with all degrees of capacity, living in all sorts of favorable and unfavorable environments, with all sorts of personality mechanisms. Where is the public school system that has frankly and honestly worked out its course of study in the light of these differences; that suggests to each grade teacher the variations in each subject that should be made for pupils of different capacity groups, having different backgrounds and different prospects; that furnishes *differentiated* norms for such pupils, so that the teacher can use them as a guide to check himself and the pupil against; and that holds up before teachers the ideal of a broad education, as contrasted with the type of achievement called for by a common test battery? We cannot expect the teacher to solve all of these problems for himself and do a perfect job of it.

Many of the writers on individualization and guidance, in the testing literature, are concerned with the high school and college. It is easier to "guide" a pupil *away* from a course in plane geometry, than it is to "guide"

him *through* the tool subjects. The elementary-school teachers face a different problem. Their problem is to see that the child attains a level of ability in reading, arithmetic, spelling, language, and fundamental understandings in the social studies that will be regarded by him in his later life, and by society, as representing the best distribution of learning opportunity in the elementary school. The tool subjects cannot be slighted; but neither should pupils be very greatly worked beyond their capacity, and neither should slow pupils be denied variety and breadth.

Individualization calls for a restudy of what should be regarded as minimum essentials in the tool subjects for each different capacity group, for each different number of years in school. Such curriculums must be viewed vertically, from the primary grades up, instead of being thought of as minor departures from the standard curriculum for any grade. And educators must look through the eyes of the dull child and of the bright child, on their present worlds and on their future worlds in conceiving the proper curriculums.

From such a perspective the ordinary use of the commercially available standard test, with an emphasis upon comparisons of one pupil with another, and of the class average with the norm, appears for what it is worth (200). Viewed in the light of the broadening objectives which educators are coming to recognize, our conventional procedures dwindle still further in significance.

We still think about education in too simple terms, and so long as we continue to do so, testing will furnish results of doubtful benefit.

Broadened Conceptions of Educational Objectives

"Probably no other factor in modern education has had more to do with a re-definition of the aims of education than has the testing movement. . . . Educators have re-defined the objectives of education in social terms, and some of them—particularly the supervisors of instruction—have demanded that the orgy of testing for knowledge and skill cease." Thus wrote Connor (174: 290). It was pointed out earlier that educational practice was apparently changing, and that test design and use was following. We shall here consider the apparent changes in objectives of education, some emanating from an advancing curriculum philosophy and some forged by the necessity of adapting testing instruments to a greater variety of important outcomes.

Leary (192) reported an analysis of 1,660 recent courses of study, indicating that 66 percent of them include among their objectives "the development of desirable attitudes, appreciations, and understandings." Samples of some of the objectives are quoted. The findings are heartening.

The Evaluation Staff in the Eight Year Study has divided desirable outcomes into the following ten areas (211:90): (a) aspects of reflective thinking; (b) interests, aims, and purposes; (c) attitudes; (d) social adjustment; (e) creativeness; (f) study skills and work habits; (g) vital

information; (h) appreciation; (i) social sensitivity; and (j) functional philosophy of life. These areas are stated somewhat more fully. They are given elsewhere by Rath (212, 213) as eight areas, with (b) and (h) combined, and (d) and (i) combined. Wrightstone (235) listed six objectives and Reene (215) four objectives which would fall under the above categories.

New York State recently adopted a revised list of cardinal objectives (203, 233) for elementary education. The list contained six objectives, stated in broad terms. Eginton (179) listed 21 areas, each with subdivisions. McCall and others (198) included 19 different areas in a test they recently constructed, which is only one of a set of four parallel tests. Other writers also contributed to statements of objectives which should be measured (182, 224).

Examples of Newer Measuring Instruments

The expanded objectives have afforded a challenge to a number of workers in the testing field, and a variety of means of obtaining evidence has been devised and experimented with. In attacking the problem, these workers have not been limited by preconceptions of what form the instrument should have, but have taken recourse to various means, such as anecdotal records, checklists, ratings, observer-diary records, questionnaires, informal reports, and interviews. Some of these instruments or procedures are ready and available for general use; others are still in preliminary stages. As illustrations of developments, the following references are given.

Rath (212) listed likely means of obtaining evidence on the ten areas of the Evaluation Staff. More recently, Rath (213) described the application of ten tests to a school system, giving illustrative samples from the tests. In another place, he (211) reported that instruments are available for help in the evaluation of certain aspects of all ten of the fields previously outlined. He described in considerable detail five of the tests. Further discussion of the development of these tests is given elsewhere (176, 214). Other contributions of the Evaluation Staff are given in references cited in the section which follows.

Wrightstone (234) showed how data can be gathered on each of the six new objectives of elementary education adopted by New York State. He (232) also reported the application of new instruments to conventional and experimental schools. Diederich (177) listed a variety of observational records and other report forms useful in gathering evidence. Zahn (237) described values of the anecdotal record. Hopkins (188) listed a number of records that should be kept.

Various new developments in testing were reported by Alschuler and Hattwick (162), Barthelmess (164), Eberhart (178), Buckingham and Lee (169), Ginsburg (184), and Ralph (209). Ellingson (180) reported on the benefit to the faculty of working on the development of an art

scale. He said that "the most significant single contribution of this experiment" is the "major change in our attitude toward our own objectives." Stalnaker (219) discussed developments in measuring English compositions.

Evaluation in the Eight Year Study

As already suggested, the Evaluation Staff, under the leadership of Ralph W. Tyler, has been active in stimulating teachers to analyze and formulate their objectives in specific, concrete terms, and also in producing instruments for evaluating pupil growth along the lines of these newer objectives. The refinement of objectives and the corresponding instrumental developments have been covered in the two preceding sections. It remains here to indicate briefly the structure of this organization.

Five years ago 280 colleges and universities agreed to waive the usual entrance requirements for graduates from thirty selected secondary schools for a period of eight years, as an experiment. One of the conditions of the agreement was that during this period the secondary schools would develop means of obtaining and transmitting to the colleges information about each student so that the colleges would be able to understand the needs of the student and to provide satisfactory guidance for him. The administrative aspects and conditions of the experiment have been described by Aikin (161) and others (182).² The problem of evaluation, and the steps taken, have been outlined in various articles, by Tyler (222, 223), Rath (212, 214), and others, and are evident in various progress reports of work (167, 207, 211, 213, 221).

The philosophy of the Evaluation Staff is set in Tyler's words (222: 413) as follows: "Evaluation is not limited to the giving of examinations. It involves the collection of any pertinent evidence which indicates the degree to which the school is attaining its objectives; that is, the degree to which the desired changes in pupils are actually taking place. . . . Instruments of evaluation include observations of pupils, records of their activities, products which they make, tests which they take, and other procedures for noting their reactions and their development. The kinds of appraisal instruments needed depend upon the kinds of changes in its pupils which the school seeks to facilitate—that is, upon its objectives."

Elsewhere Tyler (187: 10-11) wrote: "The customary method of analyzing a course as a preliminary step to making examinations has been to analyze only the content of the course. The definition of objectives in terms of expected behavior differs from the analysis-of-content method. . . . On the usual basis of test construction it would be assumed that the student is expected to remember these descriptions. An examination would then be constructed which would disclose whether or not the student remembers the details of these experiments. In contrast, a definition of objectives in terms of student behavior does more than indicate the content to

² Numerous articles on the project are listed in the *Education Index*, since 1932, under the head, "Progressive Education Association, Commission on the Relation of School and College."

be covered. It defines the reactions which a student is expected to make to this content." This distinction, which permeates the work of the Evaluation Staff, is one of the notable contributions to modern testing. It removes the concept of testing from the confines of memory responses; it directs attention to the broadened field of educational objectives as definitely as attention heretofore has been centered on memory. This emphasis, together with the statement previously quoted concerning the variety of instruments contemplated in an evaluation program, should go a long way in removing the distrust voiced by McGaughy (201: 380): "Most of the things that can be measured by our present tests, or any that can be constructed for objective use in the future, are relatively trivial and unimportant in the program of a good elementary school."

The work of the Evaluation Staff has been outstanding for the sincerity, the courage, and the resourcefulness with which intangible objectives have been defined and means of measuring them sought. The evaluation study may well prove to mark a turning point in the history of educational measurement.

Summer workshops—The Evaluation Staff has called in teachers singly, or in groups, from the various secondary schools to work at the headquarters office. In July 1936, the summer workshop was inaugurated at Ohio State University, to which teachers from the thirty secondary schools in the Eight Year Study were brought for discussion of evaluation. At that Workshop, in the one held in Bronxville in 1937, and in the five Workshops conducted in the summer of 1938 (in Bronxville, Nashville, Ann Arbor, Denver, and Mills College), new-type tests were worked out cooperatively by teachers and test technicians (207). Plans for 1939 contemplate the affiliation of these workshops with large universities. The work has been sponsored by the Progressive Education Association, with the aid of grants of funds from the General Education Board.

Testing at the College Level

The colleges have been active in developing and trying out new testing instruments and procedures. Much of this work is reported in references already cited in connection with earlier topics in this chapter. We shall here call attention only to a few publications representative of the work going on. In a report edited by Gray (186) five institutions report their examination programs, and the methods of improving examinations are described in separate chapters by three institutions. An appraisal of the work, uses of results, and needed research, are all dealt with. The cooperative test service is described. Other reports of college testing are made by the American Council on Education (163, 187), Bergstresser (167), Cheydleur (172), Eurich (181), Gerberich (183), Gore (185), Kent (191), Oppenheimer (204), University of Chicago (173), University of Minnesota (202), Valentine and Wenrick (224), and Wert (227).

CHAPTER V

Developments in Test Scoring and Analysis¹

FRED P. FRUTCHEY

THE WIDESPREAD USE of tests as a basis for understanding the needs of pupils has resulted in deep inroads on the teachers' time, or in considerable expense and delay, largely because of the time-consuming task of scoring the papers and analyzing the results. To meet this problem there have been a number of recent developments; earlier ones were reviewed by Lindquist and Maucker (253).

Devices for Identifying Correct Responses

Most of the devices which have been developed serve to identify rapidly the responses which are correct, as a preparatory step to counting. The "self-scoring" tests which appeared commercially some fifteen years ago were of this type. A number of portable machines for indicating on a special answer sheet which responses are correct, appeared some years ago, but have had little or no mention in the literature. Stenquist (265, 266) and his staff developed a procedure for doing this work on mimeograph machines. The pupil's response is made on a sheet having different spaces for different answers to a question; this sheet is then run through the mimeograph machine, which indicates, by printing, those answers that are in the correct places. Stenquist (266) reported that, "after a few hours' practice, operators can score, with sufficiently perfect precision and virtually no spoilage, at the rate of from 28 to 35 tests (answer sheets) per minute."

For hand use, Manuel and Knight (255) developed a stencil containing marks at appropriate spaces at the edges of windows. When the stencil is placed over the pupil's test paper in proper position the coincidence of the pupil's marks on the test and the stencil marks indicates correct answers, which the scorer counts. The chief advantage of this device over the usual scoring keys is that here the scorer needs to keep in mind the matching of only two symbols.

Toops' method—In connection with the Ohio State University Intelligence Test, Toops (271) developed a unique scoring procedure. This test, now in its twentieth edition, consists of a test booklet containing the questions, and an answer pad of three response sheets with a special guide sheet on top of them. These sheets are sealed together and the student makes his response by punching with a pointed stylus in the appropriate place, making his selection according to the guide sheet on the top. The second, third, and fourth sheets, all of which are punched simultaneously, have wrong-answer spaces covered with black so that the correct punches are in

¹ Bibliography for this chapter begins on page 564.

white spaces. These sheets are separated, after the testing, by trimming around the edges.

The counting of the correct responses proceeds at the rate of about one test a minute, the test covering 150 questions and requiring about two hours to take. The advantage of the three different response sheets is that they can be given to different persons to score (count), thus providing a check on the work. The sheets may in fact be shuffled and passed out to the persons who took the test, since the response sheets contain only a serial number in place of the person's name. Each person can count three sheets, which may then be reassembled and checked against each other for agreement. While the procedure requires a specially prepared set of material, it does not call for a special machine in connection with the scoring.

The International Test Scoring Machine

The most outstanding development in the scoring of objective tests is the Test Scoring Machine developed by the International Business Machines Corporation (244, 247, 248). The imperative need for such a machine to facilitate large-scale testing was sensed by Ben D. Wood in connection with over 200,000 tests given in the Pennsylvania Study in 1928. The necessity of extensive research in the design of such a machine soon became apparent, and the problem was presented to the International Business Machines Corporation. After two years of research, an experimental model was placed on the market in 1935. This model has been carefully studied and improved down to the present time.

The machine is based on the electrical conductivity of a graphite mark of a lead pencil. Responses are made in spaces indicated on a specially printed response sheet; special pencils are advised, but are not a requisite. The response sheet is then dropped in the scoring machine and a pointer indicates the number of correct responses. The response sheets can be prepared in a variety of forms, adapting them to various types of question and test situations. Different weights may be attached to different answers, as for the Strong Interest Test. According to the Corporation, "the machine records the raw scores in terms of the number of right answers, number of wrong answers, rights minus wrongs, rights minus a fraction or multiple of the wrongs; or any of these scores may be recorded in terms of percentage. Three part-scores and the score on the total test may be secured at one operation" (247:8). A unit for item analysis is being developed.

This machine thus not only does away with the necessity of counting but also with the hand manipulation of rights and wrongs after counting. Operators of average ability are reported to score from eight to fourteen tests per minute. In the New York Regents' Inquiry into the Character and Cost of Public Education, 402,600 tests were scored at an average rate of 15.6 tests per minute. Other studies of the machine have been reported (262, 276).

Accuracy—Stray marks or light marks on the response sheets sometimes fail to register on the machine. Studies of accuracy, by check-scoring the papers, showed an error of 0.15 percent in the number of items, and an error in 2.6 percent of the papers (244, 276).

Artificiality—If a test scoring machine, or other device or procedure, requires a form of recording which is unfamiliar to the pupil, the responses will not represent his behavior (knowledge) under other more natural conditions. While this fact must be recognized as a possible criticism of the use of response sheets for this machine, one must also recognize that all paper-and-pencil tests contain certain elements of artificiality, and that the difficulty with the special response sheet lies more in its unfamiliarity than in its inherent form. While this matter needs further study, and special norms may be appropriate where such sheets are used, the matter does not appear from the present studies to be serious. A coefficient of correlation of .99 was found between the conventional method of scoring 90 students' free answers to a general mathematics test and the machine scores based on the special response forms.

The Cost of Scoring

Scates (259, 260) reported that the cost of ordinary scoring was 50 percent of the cost of purchasing, giving, and scoring a standard test battery, where all operations were paid for, and 10 percent of the scoring was checked. Studies of the cost of counting identified correct responses, previously described, do not seem to be reported; but if Toops' procedure were followed, the money cost would obviously be little, or nothing. With reference to the use of the International Test Scoring Machine, it has been estimated that its use saved \$15,000 in the Regents' Inquiry in New York State. One important factor in possible saving is the use of the response sheets in lieu of marking up test booklets. One city school system reported saving enough on one order of tests to pay for the rental of the scoring machine for two years (244).

Objections to Scoring Machines

The development of test-scoring devices in the form of stencils and machines, particularly scoring machines, has met with some objections and criticisms. The chief objection is that a scoring machine is but a further step in mechanizing education. There is a tacit assumption that the machine interprets the student's answers and relieves the teacher of thoughtful consideration of the individual student. Obviously the machine can only perform a mechanical process and cannot interpret (262, 266). The degree to which a part of the process of testing is mechanical provides a place for the use of machines and hence for economy of time and labor. The most important parts of the evaluation process, however, involve human judgment and thought in constructing and administering tests, and in interpreting the results. In the testing process human judgment enters, in de-

ciding for what aspect of development to test, what kind of evidence of behavior is indicative of that development, how to get a record of the behavior, how to bring together all bits of evidence in the test record for possible interpretations to be made, how to weight each bit of evidence numerically, how to interpret the numerical measures, and what further educational experiences to prescribe. These problems cannot be decided by a machine; but there is a place in the process which involves computation, and a machine can perform the necessary computations at this point in the process.

Various Scoring Studies

A number of studies have reported on special phases of scoring. Conrad (242) and Sims (263) dealt with the scoring of rearrangement tests so as to allow for chance. Zerilli (277) and Conway (243) discussed the scoring of multiple weighted items, such as the Bernreuter Personality Inventory. Klar (250) studied the rating of pictorial compositions; Strong (268) reported on the scoring of his interest test by the use of the tabulating machine; and Lawson (251) and Bush (240) reported respectively on scoring subjective tests and true-false tests.

Statistical Analysis of Test Scores

Hollerith tabulating machines have been used to a large extent in the analysis of test results on a large scale. Such analyses are reported by Wood (275) on college tests, by Lindquist (252) on high-school tests, by Strong (268) on vocational interest tests, by Terman and Merrill (270) on intelligence tests, and by Kelley (249) on free association test results. These reports appeared in a general book on applications of the punched card method (239).

Toops (272) reported on the use of the punched card method in the analysis of questionnaire data and methods of constructing questionnaires for machine analysis. He pointed out that the machine is a valuable stimulus to the researcher because he must think through the whole process in preparing data-recording forms, even to the point of deciding upon tables to make, and possible interpretations. He must decide ahead of time what to do with unexpected responses. According to Toops, "the machines act mechanically, blindly, and unintelligently—although with an accuracy, speed, and seeming intelligence *for those operations for which they are set*, which to the casual observer, appears superhuman, as indeed it is in fact."

Interpretation of Test Scores

Stencils, or similar devices, for the interpretation of test scores have appeared in at least two publications. Allen (238) published his stencil in a separate volume, to be used as a part of a program of adjustment. The

chart is based on intelligence, achievement, and chronological age. More recently Voas (273, 274) presented reports of a somewhat similar chart, with a chart form designed to aid in the preparation of the chart. The same three basic factors or traits are involved.

Teachers of mature judgment probably regard such devices as suggestive but dangerous. If all important factors were measured, and if all factors were measured accurately, mechanical devices for interpretation would be reliable. But teachers, as well as research workers, know that all measurements must be interpreted in the light of daily observation over a long period of time, and that the results of testing alone, construed in the usual sense, cannot be relied upon to furnish data which are the sole basis for educational guidance. All mechanical schemes for the interpretation of test scores, therefore, must be used against a background of enlightened judgment.

CHAPTER VI

The Educational Measurement Movement in Perspective¹

A. Developments in Educational Measurement

E. F. LINDQUIST

SOME OF THE MOST SIGNIFICANT of recent developments in educational measurement have been neither the direct outgrowth nor the immediate object of experimental research. On that account they have tended to be neglected in reviews of this kind. These developments may be briefly characterized as follows: (a) a greatly increased emphasis upon the use of tests as a means of facilitating individualization in education, or upon the use of tests in educational guidance; (b) a consequent demand for increased comparability in the results obtained from tests; (c) a steady growth in the number and scope of cooperative regional testing programs; and (d) increasingly successful attempts to measure what heretofore have been considered the intangibles in educational outcomes, both for the purpose of improved educational guidance and for more adequate evaluation of current outcomes of educational practices.

Guidance

The increased emphasis upon the guidance values of tests has been reflected in the work of all leaders in educational and vocational guidance. The references to these uses are too numerous and scattered to permit any enumeration or individual summaries of them here. It is now generally conceded that one of the major functions of educational measurement is to enable the teacher, the guidance counselor, and the school administrator to become more intimately and dependably acquainted with each individual pupil, in order that more adequate provision may be made for individual differences in all phases of the educational program. This use of tests is now regarded by many as not only one of the major functions but as *the* major function of tests, to which all other uses should be definitely subordinated and with which no other use should be permitted to interfere (283, 292).

Comparable Scores and Norms

In accordance with this emphasis, increasingly adequate provisions are being made in school practice for the organization and systematic accumulation of test results and other relevant guidance data on permanent cumu-

¹ Bibliography for this chapter begins on page 565.

lative record forms for individual pupils. Recent developments in this area were excellently summarized by Segel (290). These efforts to organize and integrate available information about individual pupils for more effective interpretation and use in guidance have drawn attention to the need for greater comparability in test results. Unfortunately, most of the standardized tests thus far have been independently constructed with little regard to the possibility of their collective use in an integrated guidance program. The norms for these tests have been independently established at different times and under different conditions, each for a group of pupils and schools differing in geographical distribution, in type of organization, and in level of achievement from those used in the standardization of the other tests. Because of these variations, the norms have differed considerably, sometimes by as much as several grade levels, even for tests intended for the same subject. Consequently, when an educational profile was constructed on the basis of percentile or grade norms for a number of these tests, it was impossible to tell to what degree the peaks and troughs in that profile were due to real differences in the abilities of the pupil and to what degree they merely represented accidental variations in the norms provided for the tests. The urgency of the need for increased comparability in test results, from the point of view of educational guidance, was expressed by Wood (287).

In general, high comparability in results for any set of tests can best be obtained by establishing the norms for all of these tests at the same time and under the same conditions, for exactly the same group of pupils and schools. It is here that the cooperative or regional testing program makes one of its most important contributions. Through such programs, it is not only possible to secure highly dependable and meaningful norms on each test individually, because of the size and homogeneity of the population used, but also to establish norms simultaneously on a large number of tests for the same population and to maintain comparability in these norms from year to year. In fact, it now appears that cooperative organization in testing, such as that represented by the Cooperative Test Service of the American Council on Education or by the various regional testing programs, is the only practicable means of establishing norms of this type. This and other advantages of wide-scale cooperative organization in achievement testing were summarized in a bulletin (284) describing the 1938 Iowa Every-Pupil High School Testing Program and are discussed also in the descriptive literature provided for many other programs. The growth of this cooperative movement is evidenced by the fact that some type of organized program is now in operation in some twenty-six states. It appears likely that this trend will continue, and that in the future the great bulk of all testing for guidance will be done through the regional testing program.

In spite of the importance of the problem, relatively little research has been reported on this matter of comparability. A study by Crawford (279),

not hitherto reported in the literature, set forth convincing data on the operation of certain factors, such as chronological age, mental age, grade placement, and school progress in test norms. The results indicated a definite need for much more effective control of these factors in selecting the population for the determination of test norms. Crawford suggested the establishment of norms on groups selected for normality in each of the factors named above, and pointed to the need for much more highly refined norms in most fields of educational measurement.

A scaling technic which is intended to control many of the variables ordinarily present in comparisons of test results is proposed by Flanagan (280). Scores expressed on a common scale are now provided with most of the tests published by the Cooperative Test Service. A score of 50 on this scale represents a score which the average child would make at the end of the particular course tested if he had attended an average school and had taken the usual amount of the subject in question. A Cooperative Test Service booklet containing a complete discussion and explanation of this system of scaled scores is now being prepared and should become available before the publication of this review.

Measuring Intangible Outcomes

One of the most encouraging of recent major trends is evidenced in the numerous, and increasingly successful, attempts to define more clearly and to measure more objectively the attainment of some of the more intangible educational objectives which have heretofore been neglected. A significant proportion of recent contributions of this type have come from the Evaluation Staff of the Commission on the Relation of School and College of the Progressive Education Association. By agreement with two hundred and eighty American universities and colleges, thirty secondary schools preparing students for colleges have been freed from the usual college entrance requirements and entrance examinations, and have thus been able to introduce experimentally certain important modifications in their educational offering. The task of the Evaluation Staff has been to develop procedures by which the changes taking place in the boys and girls in these schools may be identified and by which each school may discover from year to year how well it is accomplishing its educational purposes. The essential features of this evaluation program were described by Tyler (291) as (a) the use of the major educational objectives as the basis from which the evaluation program proceeds, (b) a conception of appraisal which is not limited to tests and examinations, and (c) a cooperative activity in which individual schools working with an advisory technical staff are developing new appraisal instruments where satisfactory instruments are not available.

Some of the work of the Evaluation Staff has been reported by Wrightstone (294, 295, 296). It is hoped that some of the instruments produced in this Evaluation Study may soon be made available for general use.

Numerous other efforts to measure hitherto neglected educational outcomes have been reported in the literature. Frutchev (281) described a cooperative program developing the ability to use a scientific method in college sciences. Buckingham and Lee (278) reported on a technic for testing unified concepts in science. McDowell and Anderson (285) described a test of the ability of pupils to outline. Noll (286) discussed the measurement of the scientific attitude, and Grim (282) described a technic for the measurement of attitudes in the social studies. The students of Remmers (289) at Purdue have been particularly active in developing and applying scales for the measurement of generalized attitudes.

B. Current Criticisms of Educational Measurement

S. A. COURTIS

The measurement movement in education always has been criticized and it is safe to prophesy that it always will be. It should be.

At the turn of the century when the concepts of modern educational measurement were just being formulated, and survey measurement activities were novel, misunderstandings and criticisms were inevitable. The center of emphasis then was almost wholly upon measurement of efficiency in the tool subjects of the elementary grades. Today measurement has spread upwards to the colleges and adult education (299, 300, 303, 305), inward to the measurement of "intangibles" (315), and downward to the preschool child (298, 301). Its purposes are as broad as science itself. But even today, as the influence of the movement reaches new areas and fields, the old conditions of novelty and misunderstanding are recreated in those fields. Fresh critics voice the limitations and deficiencies of measurement (297, 307), and in reply others reformulate, in modern terms, fundamental purposes and warnings (308, 311, 312).

During the past three years opposition to measurement has not been much in evidence in the literature, but under the surface, among the rank and file, there are still dissatisfactions, as those in touch with teachers know (309, 310). It is, nevertheless, encouraging to find that out of one hundred and forty-three persons in administrative positions in our schools, less than ten considered the measurement problem urgent enough to feel that it should be discussed with parents (313). The really vital criticisms do not appear in print *as such*, but take form as efforts to achieve better tests, procedures, or statistical technics. The measurement movement as a whole progresses by these small steps of advance, each of which has motivating drive in some real dissatisfaction.

Among the severest critics are workers within the movement. Thus, one leader in the field of factor analysis wrote: "A large majority of these papers involve misinterpretation of the factorial methods. . . . If the misapplication of factor methods continues at the present rate, we shall

soon find general disappointment with the results because they are usually meaningless as far as psychological interpretation is concerned" (314). Another statistician said: "Possibly a few would take issue with the first part of this battle cry (that anything that exists at all exists in some quantity); some would deny that all traits are susceptible of quantitative measurement; and many would agree that not all we attempt to measure exists. . . . The entire conceptual basis underlying factor analysis does violence to all that is known about the processes of growth and development. . . . When as sometimes happens factors wrung out of an analysis are interpreted as some kind of stable entities, progress toward personality measurement would seem to be impeded. . . . It will doubtless be necessary to resort to cumulative developmental studies" (302). One psychologist fulminates: "From a certain point of view the history of mental testing is primarily a history of the idol worship of the parameters of the bilaterally symmetrical curve. . . . It is unfortunate that so many laymen have been so easily misguided into the faith that any wishful product of imagination converted into numbers by authoritative proclamation constitutes science and scientific method" (306). There are even measurement men who, on the basis of evidence *conclusive to them*, take the position that "no single test and no battery of tests of any type or description yields unambiguous information about the quantities educationalists wish to measure. . . . They (the present day tests) are not more adequate than were the measuring instruments of the alchemists and the astrologers" (304).

Certain persons appear to be much distressed by such criticisms; but some criticism is an aid to healthy growth. It appears that more criticism is directed against the theory than the practice and becomes largely an intellectual matter. By way of analogy, we may note that in Berne, Switzerland, and in many other cities of the Old World, fourteenth-century town clocks, whose machinery was designed on the basis of the now discredited Ptolemaic astronomy, still keep good time. So in education our tests and theories of measurement may be totally invalid, but it cannot be denied that many a teacher has been stimulated by their use to new effort, new enjoyment of his work, and new interests in his children. In spite of the opinions of the extremists who characterize the prevailing uncritical but practical use of measurement by schools as the grossest pseudo-science, such measurement may serve useful ends. To some extent we are all pragmatists; if we believe we can get benefit from an activity, we are likely to continue the activity.

The danger is that we shall be *too* pragmatic. While continuing to do things which are useful, we must keep alive those critical faculties by which the conventional and the plausible may be unmasked and errors of direction detected. For in the long run, it is truth alone that enables man to extend his conquest and control of nature.

C. Past and Present Trends in Educational Measurement

S. A. COURTIS

The determination of trends is a matter of judgment and interpretation. Even the tabulation of frequencies of articles rests upon judgment as to the type into which any given article falls. Any value in the discussion of trends below must therefore be sought more in the suggestiveness of its interpretations than in its factual basis.

The present major trends in educational measurement are judged to be five in number as follows:

1. A trend toward standardization
2. A movement away from the determination of laws
3. A growing dependence upon statistical analysis and deductive reasoning
4. An increase in observational personality and character rating
5. A greater emphasis on longitudinal studies of individuals.

Background

In discussing present trends, some reference should be made to the contributions of the past. From Rice (1894) to Thorndike (1910), educational measurement was little more than a novel and interesting variation of the conventional examination—the attempt to adapt to education some of the methods and procedures used by Cattell (1885) and other early psychologists in the study of individual differences. Thorndike's handwriting scale, the first calibrated educational ruler, supplied, not another novel examination, but something new—*units* of measurement based, supposedly, upon a universal law or principle (the Fullerton-Cattell Equal Difference Theorem). It was hailed with an enthusiasm which measurement men of this generation would have difficulty in appreciating. Finally, many believed, the day of exact science had dawned for education. At last precise knowledge, prediction, and control were to be had in return for scientific effort.

The period from 1910 to 1920 was one of rapid growth and creativity. Binet's concept of mental age was just beginning to influence psychological thinking, and education went "scientific" with a vengeance. Hillegas, Buckingham, Ayres, Trabue, Woody, Terman, and others discovered ways of extending basic concepts to other subjectmatter fields. Otis devised the group intelligence test that enormously extended the range of mental measurements. Tests and test-users multiplied at a rapid rate. The utilization of tests by the United States Army during the War served to bring measurement to popular notice and give it a prestige it might otherwise have taken many years to acquire.

The decade from 1920 to 1930 was the period of the great depression in measurement. The novelty and the glamor of a new fad was over. Funds were increasingly scarce. Creative attention shifted to other fields—curriculum revision, the activity movement, the development of better school-

community relationships. School measurement activities continued as routinized reminders of the obligation of education to be scientific and as a fruitful field of these subjects for candidates for academic degrees. Correlational studies multiplied; then a new type of creative activity came to the fore. Spearman's emphasis in England on general and specific factors stimulated an entirely new approach to the problem of test construction, ably propagated in this country by Holzinger, Thurstone, and others. And thus a new upward surge or cycle of development came into being. It is from the perspective of these three periods that the trends in 1936, 1937, and 1938 are viewed.

Standardization

Bureaus of educational research found it necessary to standardize tests and procedures within the school systems they served. The same need existed over larger areas, and a number of states developed statewide testing programs, some of which were remarkable for their consistent self-improvement through critical analysis. Nationally, the Cooperative Test Service of the American Council on Education and similar agencies (320, 324) are rapidly standardizing measurement instruments and procedures as much as it is possible to standardize them in a democratic country. The invention of mechanical aids to scoring is an aid in the same direction.

Fundamental Laws

Of the original impetus—the creation of a science of education in terms of law, prediction, and control—little remains. The language persists, but not the substance. From time to time new attempts are made to discover law or to establish units (329, 330, 332, 345), but such factors as the growing confusion of fact and theory in physics and astronomy, the increasing dependence on statistical procedures—justified in terms of logic not experimentation, including the complacent acceptance of correlation coefficients of 40-70 as indications of satisfactory prediction (327, 344)—the increasing separation between test-makers and test-users, are all developing a widespread conviction that extraneous units, laws, and control in human behavior are neither feasible nor desirable.

It is felt by some that measurement has failed of its early promise. In teaching and pupil administration, we are scarcely nearer a science of education today than when we started. The reason is that technics of measurement and statistical methods of analysis have had to be transferred from static fields to a dynamic one. In physics, the length of a bar of iron changes only as conditions change, and these can be largely controlled. Static measures and interpretations suffice. In education, however, the child, learning, and ability are living, growing entities. They are affected by subtle factors and change rapidly. They can be correctly measured and appraised only in terms of units and procedures adapted to living and

rapidly changing traits. It is significant that even the first attempts to move in this direction have been productive (321).

Dependence on Deductive Reasoning

The element which more than any other differentiates science from all other forms of human achievement is its acceptance of an authority outside itself as a court of last resort. The basis of the scientific method is the pragmatic empiricism of the cycle—experimentation, generalization, prediction, and verification.

Mathematics, on the other hand, is deductive. Statistical procedures start from assumptions and grow by logical deduction. It is interesting to follow the derivation of a theorem from an assumption, particularly in a field where much experimental evidence contrary to the theorem is available (340). Often it is not possible to check the end product of deductive reasoning experimentally, and when it is done the result is often surprising (317). Increasingly in measurement articles, justification is based upon logical, mathematical reasoning instead of upon concrete experimental evidence.

By the degree that such action is taken, the gap between the specialist in test and scale construction, and the user of tests in the classroom, is likely to become widened. Teachers cannot read and understand current discussions of item analysis, factor loadings, correlation pathways, and the host of statistical methods and proofs to be found in measurement articles (316, 331, 333, 334, 343), but they do sense the contrast between the promises of educational measurement and the actual inadequacies of tests in the classroom. Deductive reasoning has its place, but there is need to ask the question, Is the trend toward increasing statistical complexity, when unchecked by objective experimentation, a desirable advance or a menacing illusion?

Measurement by Observational Rating

Teacher antagonism toward measurement has frequently been based on the wide separation between the narrow products measured by the early tests and the objectives for which the teachers are working. Character, personality, and ideals are almost universally acknowledged to be higher, more important goals than elemental knowledges and skills. There has been an increasing trend toward some form of quantitative evaluation of the so-called "intangibles." In this direction may be noted the time-sampling technic, the behavior rating scales, and other observational ratings (335, 338, 342), either direct or aided by objective devices such as the tests developed by the Eight Year Study of the Progressive Education Association (336, 337, 341). The influence of this trend has extended far and wide, two of the most notable results being the revision, on all educational levels, of examinations (319) and of marking (318).

Longitudinal Studies

The event of the period covered by this review has been the flowering, so to speak, of the Harvard Growth Studies (323) and others, and the publication of the monographs of the Society for Research in Child Development (339). A new term has been coined, "longitudinal," in contrast with "cross sectional," measurement, and an idea long gestating has come to birth, namely, that interpretation of a child's measurements should be in terms of his own growth curve and not in terms of norms derived from mass measurements. Longitudinal studies demand new types of records, new controls, new statistical methods. Although Baldwin and his successors started collecting cumulative records on individual children many years ago, few persons even yet sense the implications and potentialities of this form of measurement.

Mention should be made of the publications by Dearborn (323) and by Davenport (322) of their full raw data which makes available, to all, the wealth of information painstakingly collected over many years.

CHAPTER VII

Recent Literature on Testing¹

DOUGLAS E. SCATES

THE PURPOSE OF THIS CHAPTER is to list the recent systematic literature dealing with testing and to report technical references on test construction. The entire bibliography of the present issue of the *Review of Educational Research* is of course a presentation of recent literature on testing, and this issue may be regarded as one item in the list of bibliographies presented below.

Bibliographies of Tests

The basic bibliography of commercially available tests at the present time is by Hildreth (352), and covers educational, intelligence, personality, and environment measures. Information on new tests has been kept up to date by Buros (346, 347, 348), both in a series of annual bulletins and in the monthly checklists appearing in the *Education Index* (350). This year Buros (348) inaugurated a test review service which is unique and should prove valuable. It is designed to render the same service with reference to tests as book reviews render for new books.

Odell (356, 357) revised and brought up to 1936 his earlier test bibliographies. Catalogs of test depositories also are serviceable for current information. Other lists of tests will be found in the discussions referred to in the sections which follow. For descriptions of some of the newer testing procedures designed to gather evidence on some of the less tangible aspects of growth, one should consult the references cited in Chapter IV in the section on "Examples of Newer Measuring Instruments."

Bibliographies and Digests of Achievement Test Literature

The bibliographies and discussions in the *Review of Educational Research* (358) on educational tests in the preceding cycle may serve as a starting point. South (360) prepared an extensive index of periodical literature on testing, which is arranged by author, with a subject index. Monroe and Shores (355) covered test bibliographies from 1910 to 1935, under such heads as "Test Construction," "Testing Programs," "Tests and Scales," and cross references were given. Jones and Brown (353) in 1935 summarized recent educational test literature in some detail.

Swineford and Holzinger (361) published annotated selected references each year since 1933, adding the topic "Factor Analysis" for references published in 1936 and later years. The United States Office of Education (351) publishes annually its lists of research studies, which are predominantly master's and doctor's theses. Testing is covered under a general head "Tests and Testing," with five subdivisions, in the table of contents,

¹ Bibliography for this chapter begins on page 568.

and mostly under "Tests and Scales" in the subject index at the back. Many of these references are annotated.

The *Education Index* (350) must be regarded as the most important source of information on current testing literature. The principal heads to consult are: "Achievement Tests," "Educational Measurements," "Tests and Scales," "Intelligence Tests," "Personality Tests," "Social Intelligence Tests and Scales," "Behavior Tests and Scales," and numerous cross references to other heads. Buros (347, 348) should be consulted for recent books on testing, including excerpts from reviews of books. The books and reviews on statistical and research methodology in the 1938 edition of his bibliography have also been printed separately (349).

In the bibliography of Canadian education compiled by Smith (359), references to testing will be found under the heads "Educational Measurements," "Tests," and "Factor Analysis."

Literature on Intelligence and Personality Measurement

Although theoretically this literature falls outside the scope of the present issue of the *Review of Educational Research*, a few summaries can be referred to briefly. The June 1938 issue of the *Review* (363) dealt with these areas, as did also issues in two earlier cycles. The works referred to above (347, 348, 350, 353, 355, 359, 360, 361) will yield references in these areas as well as in achievement if the proper sections or heads are consulted.

In the field of personality and environmental measurement Symonds' 1934 publication (362) may be considered a basic work still, giving half of its pages to a description of data-gathering instruments. Maller (354) revised his earlier list of tests bringing them down to 1937. Traxler (364) printed a brief list, with discussion, and Vernon (365) did somewhat the same thing in England.

Textbooks Dealing with Achievement Testing

Books, textbooks and others, which have appeared in the field of measurement—achievement, intelligence, personality, and environmental—beginning with 1933, are listed, with reviews, by Buros (347, 348). We present here a list limited to textbooks in the field of achievement tests published since the middle of 1935. Buros may be consulted for reviews of these books.

Greene and Jorgensen (367, 368) revised, expanded, and divided their earlier treatment so that separate books are now available for elementary- and high-school fields. The books contain a sufficient amount of material in common so that they can be used together in the same class, and can be divided according to student interest. Greene collaborated with Newkirk (371) in the preparation of a volume especially for industrial education. Lee (370) produced a textbook for high-school tests, and Orleans (372) and Rinsland (373) published general texts in 1937. Orleans em-

phasized use and Rinsland prepared the most complete assemblage of rules to date for making objective tests of various kinds. They are addressed primarily to the classroom teacher. The American Council on Education sponsored the production of a book on test construction (369) which represents a composite of points of view. It is the most thought-provoking book yet to appear, though pitched somewhat above the level and range of interests of typical graduate classes. Wright (375) prepared a "measurement-at-a-glance" type of outline. Smith (374) attempted to center attention on principles. In general, the textbooks of this period evidence a tendency away from the detailed description of commercially available tests.

Literature on Statistical Methods in Test Construction

Cureton and Dunlap summarized the literature on statistical contributions to test construction and analysis in the June 1938 *Review of Educational Research*. We present here a number of references which continue their bibliography (376-404). In view of the recency of their treatment, it does not seem appropriate to summarize the material at this time; it is therefore presented simply as a checklist. Present plans call for another summary of statistical material in the December 1939 issue of the *Review*. For a checklist of books, bulletins, and monographs dealing with statistics in general, Buros (347, 348, 349) may be consulted.

This bibliography emphasizes statistical technic. For references on test construction which place less emphasis upon statistics, consult numbers (369, 373), and references cited in the last three sections of Chapter IV.

Statistics in Test Development and Interpretation²

The rapid strides which have been made recently in the effective use of statistical methods in the development, critical refinement, and more meaningful interpretation of educational tests are very encouraging signs of progress in educational measurement. Many competent mathematicians have come to recognize the contributions which their scientific training may make to theory and practice in educational measurement. The result has been a marked improvement in the training of research students in education. Today a rather surprising number of educators are qualified by training and experience to make critical and legitimate use of refined statistical procedures in the field of measurements. Psychologists have met their problems in a similar way, with the result that many significant contributions to the literature of measurement dealing with critical refinements and meaningful interpretations of test results have been made by those interested mainly in the psychological aspects of the problem. Thus, educators and psychologists, both being concerned with problems of measurement, are both concerned with the contributions which statistical techniques can make to the solution of their problems.

² Paragraph by Harry A. Greene.

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Chapter VI. The Educational Measurement Movement in Perspective

A. Developments in Educational Measurement

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